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A QUANTITATIVE STUDY OF THE BACTERIA IN CITY DUST WITH SPECIAL REFERENCE TO INTESTINAL AND BUCCAL FORMS

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I. DUST AND DISEASE.

The bacteriology of dust and the relation between dust and disease have been discussed in two of the most notable books in the history of sanitary science. In Tyndall's "Essays on the Floating-matter of the Air" (1881), which is a literary classic as well as a masterpiece of scientific investigation, it was first demonstrated to the English speaking public in a comprehensive and yet popular fashion that the motes which give brilliance to the sunbeam are the bearers of living germs some of which may be the agents of infectious disease. In Prudden's little work on "Dust and Its Dangers" (1890), the same general facts were presented to the American public in so delightful a fashion that the last new edition of the book was issued twenty years after the first.

Ever since Tyndall's studies, and the basic work of Pasteur from which they drew their inspiration, the relation between dust and disease has been a fruitful subject for experimentation and perhaps a still more fruitful subject for debate. Epidemiologists have offered evidence in regard to outbreaks of various diseases in which the infection was held to be dust-borne; bacteriologists have checked the probability of such conclusions

by experiments on the resistance of specific disease germs to drying and by studies of the actual germ content of dust deposited on surfaces and suspended in air.

The epidemiological evidence for dust-borne disease is admirably reviewed by Chapin in his "Sources and Modes of Infection" (1910). It is needless to go into the subject here except to point out that with the exception of anthrax, the evidence of infection by air or dust is practically *nil*. The case of anthrax is unique in the fact that the causative organism forms spores; and anthrax is undoubtedly spread among handlers of wool and hair by infected dust contained in those materials. Silberschmidt (1896) gives a good example of the spread of anthrax among horses from a hair factory, in part at least by aerial infection. With the exception of this disease, however, the recorded air epidemics appear to be simply epidemics in which water, food and direct contact with known cases of disease could not be shown to be at fault and in which the investigators therefore concluded that infection must have been transported in the air from a distance. With our modern knowledge of carrier cases this supposition appears quite needless and almost all the supposedly air-borne outbreaks are seen to present the usual features of contact or fly epidemics due to carriers or unrecognized cases. Not only is there no evidence that epidemics of disease are due to dust or air but there is a strong probability that even single isolated cases of disease are very rarely due to infection by way of ordinary quiet air. This conclusion may be drawn from the experience of numerous hospitals which have been operated with success in recent years on the principle that contact was the great danger to be guarded against and that air infection need not be considered. In the Pasteur Hospital in Paris, the Monsall Hospital in Manchester, the Minturn Hospital in New York and the new City Hospital in Providence various contageous diseases have been treated in open wards or in rooms opening on a common corridor with much less cross infection than is usual in a hospital with separate pavilions. Still more important and significant is the general agreement among surgeons that air-borne infection plays so small a part even in the causation of wound diseases. The streptococci and staphylococci of suppuration are known to be often present in the air and Lister's earliest antiseptic precautions were directed primarily against infection of this kind. Yet to-day it is universally recognized that contact infection is the principal danger of the operating room and that the dust in quiet air is a factor of little or no practical importance.

In view of this evidence and of much more which is summarized by Chapin (1910) in his epoch-making book, the conclusion seems to us obvious that the transmission of disease germs to any distance through the air of an ordinary quiet room is so rare a phenomenon as to be practically negligible. Infection may undoubtedly be spread by mouth spray thrown

out in coughing, sneezing and loud speaking; but it appears that this infection is only considerable in amount in the immediate vicinity of the sick and is really more like a form of contact than true aerial infection (Winslow and Robinson, 1910). All this, however, does not necessarily close the question of dust infection under certain special conditions. It may be true that aerial infection is negligible in ordinary quiet air and yet infection may be carried to an appreciable extent when clouds of dust are blown about by winds in the street or stirred up indoors by the careless housewife. There is, so far as we are aware, no epidemiological evidence tending to show that disease is carried in this way but on the other hand such negative evidence as that of the hospital experience just cited does not bear in any way against it. In estimating the probability of such transmission we must at present fall back on bacteriological data.

Bacteriological evidence bearing upon this point is of two kinds, that which indicates the possibility of a given disease germ being present in dust, as shown by its ability to survive under experimental conditions, and that which shows the actual germ content of dust as it exists under natural conditions. Experiments on the capacity of various pathogenic bacteria to withstand drying have been made by many investigators and no attempt will be made here to review them with any completeness. Chapin (1910) has covered the ground with his usual thoroughness and those who wish to pursue the subject will find an excellent summary with original references in the "Sources and Modes of Infection." The results obtained by various observers are somewhat discordant, largely because of the varying conditions under which the experiments were carried out. Bacteria dried in a mass of feces or sputum may not be really dry at all, being protected by the drying of the outside of the mass, and under such conditions they live much longer than when dried in a thin layer on glass or when mixed with fine sand and dried upon its surfaces. The extent to which the organisms are exposed to light is an important factor and still another is temperature, the dried bacilli surviving much longer at low temperatures, as shown by Rosenau (1901) and others. We shall briefly refer here to a few of the more important results obtained by investigators who dried their bacteria in sand or earth so as to approximate somewhat the conditions that would obtain in the case of dust borne infection.

All observers are agreed as to the very low resistance to drying exhibited by the bacilli of influenza and plague, the microspira of cholera and the diplococcus of gonorrhoea. B. influenzae and D. gonorrhoeae under the most favorable conditions, when dried in sputum and in pus only survive from two or three to thirty-six hours (see Chapin, 1910). With regard to bubonic plague the work of Kitasato and Wilm (cited by Germano, 1897), of Germano himself (1897), of the German Plague Commission and Tidswell (cited by Chapin, 1910), of Rosenau (1901) and Buckley (1907) is

reasonably concordant. In a moist condition the bacilli persist for considerable periods, (60 days, Germano, 1897; 125 days, Rosenau, 1901) and when dried on fabrics or in sponge they may survive for a long time (on fabrics for 30 days, Germano; in sponge at a low temperature for 125 days, Rosenau); as a rule however they perish quickly, particularly when dried in sand or earth or sawdust (5 days, Germano, 6 days, Rosenau). The cholera organism may live in the moist condition for 19 days (Buckley, 1907) or 30 days (Germano, 1897). Berckholz, (1889) records one case of extraordinary resistance (186 days for a culture dried on a thread in a dessicator) but most of his cultures perished in a few days. Manfredi (1891) records a survival period of 2 weeks when dried in a mixture of sweepings but he worked with unsterilized dust and his identification of his test organisms after isolation from it is exceedingly dubious. Gotschlich (cited by Chapin, 1910) found that cholera dejecta dried on clothing contained comma organisms after 36 days. All the other experimenters, Kitasato (1889), Uffelmann (1893), William (1893), Dempster (1894), Wittlin (1896), Germano (1897), and Buckley (1907), found that the comma organism could not survive drying for over four days, and often disappeared after a few hours.

The typhoid baccillus appears to be a little more resistant than these very sensitive organisms. Dried on wood or fabrics it survives for a considerable period, 85 days, (Uffelmann, 1894), 90 days, (Germano, 1897), 91 days (Buckley, 1907), 97 days (Pfuhl, 1902). Uffelmann records a survival period of 82 days in filter sand but as a rule drying in sand, earth, sweepings, etc., gives a much shorter period. Uffelmann himself found a maximum of 21 days in garden earth and 30 days in sweepings. Other observers report maximum periods of 5 days (Harrison and Harrison, 1904), 1–5 days, (Shattock and Dudgeon, 1912), 16 days, (Germano, 1897), 18 days, (Dempster, 1894), 25 days, (Firth and Horrocks, 1902), 28 days, (Pfuhl, 1902), one month, (Manfredi, 1891), and 49 days, (Martin, 1898). Manfredi's results are open to the objection noted above. In most of these experiments the bacilli usually disappeared in a much shorter time. Kirstein (1902) found that typhoid bacilli sprayed in the form of fine liquid droplets disappeared in 24 hours. Pfuhl (1902) found the dysentery bacillus much more sensitive to drying than B. typhi.

The diphtheria bacillus appears to have about the same resistance as the typhoid organism. Germano (1897) cites various workers who found that on surfaces and fabrics it could survive for three to five months. Hill (1902) found 9% of a series of infected glass rods still showing growth after 20 days while rods infected with tubercle bacilli lost their virulence under similar conditions in 16 days. On the other hand when dried in dust it succumbs more quickly and Flügge and Pernice and Scagliosi (cited by Chapin, 1910) maintain that it is killed out by the time it is dry

enough to be blown about. Kirstein (1902) in the experiments with fine infected droplets to which reference has just been made, found that B. diphtheriae survived for 24–48 hours in diffuse daylight and for 5 days in a dark cellar. Germano (1897) working directly with cultures dried in dust reports survival periods of 16–50 days when dried in sand, earth, etc., in the room and of 20–60 days when the drying was carried out quickly in a desiccator. Buckley (1907), found the same difference in drying the bacilli on various surfaces. The maximum period varied from 6 to 41 days when the drying was done in the room and from 20 to 88 days when it was done in the desiccator. Reyes (1895), reports a longer survival period, 100 days, in cement powder, while in sand his culture lived only 14 days.

A third class of organisms, highly variable in resistance to drying, but on the whole distinctly hardier than B. typhi and B. diphtheriae, are the pathogenic cocci of various types. It is interesting to note that Pfuhl (1902) and Firth and Horrocks (1902) found the typhoid bacillus lived longer moist than dry; Dempster (1894) found typhoid and cholera organisms lived better moist than dry; Germano (1897) notes that plague, typhoid and cholera bacteria lived better moist than dry while B. diphtheriae survived equally well under both conditions; Buckley (1907) reports longer survival periods for B. pestis and M. comma in the moist condition while B. typhi and B. diphtheriae lived equally well in either case. On the other hand Germano (1897) found longer survival periods for the pneumococcus and streptococcus when dry than when moist and Buckley (1907) notes the same thing for the aurococcus and streptococcus. Wittlin (1896) however, reports a contrary result with the aurococcus.

With regard to the meningococcus and pneumococcus evidence is conflicting. Germano (1987) found his meningococcus alive after 80–90 days whether moist or dry and Jaeger (1899) reports a survival period of 127 days in pus dried on cloth. On the contrary Chapin (1910) cites Councilman, Albrecht and Ghon, Bettencourt and Franca, Kache, Kutscher, Flügge, and Arkwright, all of whom found the meningococcus would not survive drying for more than 9–72 hours and Lingelsheim who could only keep it alive in sputum for 5 days. It seems probable that the earlier workers did not use the true meningococcus. For the pneumococcus Germano (1897) quotes Foà and Bordoni-Uffreduzzi as finding a survival period of 45 days and Guarnieri, periods varying between 90 and 120 days. Pastella records a lower resistance and Kruse and Pansini noted great variation between different strains, (Germano, 1897). Germano's own results bear out the latter assumption. One strain dried in earth, sand, etc., lived as a rule only 2 days, the longest period being 8 days in an experiment carried on at 0°. On the other hand another strain lived from 30 to 75 days under similar conditions. This strain however appears from the author's description to be nearer the streptococci than the pneumococci. Other sup-

posed pneumococci lived in dried blood for 3–5 days and dried pus for 12–16 days and pneumonic sputum contained the organism in a virulent condition after 12–16 days when moist and 16–140 days when dry.

Dubious and puzzling as these results in regard to the diplococci appear to be, there is no doubt at all as to the high resistance of the other cocci belonging to the genera, Aurococcus and Streptococcus. Haegler (1892) dried pus on cloth and powdered it and found the aurococcus alive after 56–100 days. Buckley (1907) reports the aurococcus as surviving for 35–140 days on surfaces whether dry or moist. Shattock and Dudgeon, (1912) give a survival period of 21–84 days when dried on glass. Manfredi (1891) found it alive after 1 month in dried street dust but his experiments as noted above are of doubtful accuracy. Wittlin (1896) mixed a culture with street dust and recovered the aurococcus after 30 days when moist, after 3 days dry in direct light and 6 in diffuse light. Kirstein (1902) found the organism alive after 8–10 days in fine droplets in the diffuse light of a room and after 35 days in fine droplets in a dark cellar and after 28 days in fine dust in the room. Buckley, Kirstein and Shattock and Dudgeon found it more resistant to drying than B. typhi, Buckley and Kirstein more resistant than B. diphtheriae, Buckley more resistant than B. pestis and M. comma, Haegler more resistant than the streptococcus and Kirstein more resistant than the tubercle bacillus.

For streptococci Haegler (1892) found a survival period of 14–36 days for pus dried on cloth and then powdered. Germano (1897) cites the results of earlier workers, (Pasquale, Lingelsheim) as giving periods varying between a few days and many months under various conditions. Germano himself worked with three different strains dried in sand, earth, etc., and found that one lived when moist only for 5–30 days and when dried in the room for 20–40 days. The other two survived drying for 50 and 60–120 days respectively. Kirstein (1902) reports that in fine spray streptococci lived 10 days in the diffuse light of a room and 38 days in a dark cellar. They were more resistant than B. typhi, B. diphtheriae and B. tuberculosis under these conditions.

M. melitensis resembles the pus cocci, to which it is related, in somewhat high resistance surviving 16 days dried on cover slips, 20 days in sand, 80 in fabrics and 27 in dry soil, (Horrocks, 1905).

More attention has been paid to the bacillus of tuberculosis in drying experiments than to any other organism, ever since Koch (1884) in his classic paper quoted an experiment by Fischer and Schill in which it survived drying for 186 days and urged the importance of dust as a means of spreading infection in this disease. Cornet (1889) attracted the attention of hygienists to the problem of dust infection and Flügge and his pupils, Neisser, Beninde, Sticher, Heymann, and others, in many papers published in the Zeitschrift für Hygiene (Volume XXVII, XXX, XXXVIII) con-

firmed Cornet's main contention that tuberculous sputum, dried and reduced to powder, could cause tuberculosis when inoculated, ingested or inhaled. The earlier workers were able to show a very high resistance for the tubercle bacillus when dried on surfaces or fabrics. Chapin (1910) cites many observations in which the survival period ranged between 1 and 9 months. Manfredi (1891), this time making inoculation experiments, found tubercle bacilli alive in street dust after 2 months. Stone (1891) dried sputum in a jar and after keeping it for three years found it still virulent, though only slightly so. Later workers, as in the case of the pneumococcus, report more moderate survival periods. Hill (1902), even with cultures dried on glass, found the tubercle bacilli gone after 16 days. Kirstein (1902) reports that in fine spray they live 5 days in the diffuse light of a room and over 22 days in a dark cellar. In fine dust he found them alive after 3–14 days (Kirstein, 1905). Cadéac (1905) found sputum dried on glass and marble and kept in diffuse light would remain virulent for 10–14 days. Kuss (1908) found that sputum dried in a thin layer would remain virulent in the dark for 40–45 days and in diffuse light for 20 days while dried in dust it remained virulent for 17 days.

Conditions differ so much in different experiments that it is somewhat hard to compare them. Exhaustive studies of several species under comparable conditions have however been made by Germano (1897), Neisser (cited by Chapin, 1910), Kirstein (1902) and Buckley (1907). Germano and Neisser dried the bacteria in dust, Buckley dried them on surfaces and Kirstein suspended them in fine spray. Germano placed the cholera, plague and typhoid organisms in the least resistant class, B. diphtheriae, the streptococci and some penumococci in an intermediate group and the meningococcus and some pneumococci as most resistant. Neisser concluded that cholera, plague, typhoid, diphtheria, and pneumonia could not be dust-borne, while the meningococcus, the pus cocci and the tubercle baccillus might be carried in dust. Kirstein found the typhoid and diphtheria organisms least resistant, the tubercle bacillus more so and the aurococcus and streptococcus most resistant. Buckley found that B. pestis and M. comma perished quickly when dried while B. diphtheriae and B. typhi were more resistant and the aurococcus most so. Reviewing all the evidence it seems clear that the spread of cholera and plague, influenza and gonorrhoea in dust is practically impossible and that of typhoid fever and diphtheria possible though not probable, while the tubercle bacillus and the pus cocci are the forms most likely to be spread in this way. The resistance of the pneumococcus and the meningococcus seems to be in some doubt. All bacteria (except perhaps spore formers) seem however to suffer a more or less rapid reduction in drying. Thus Manfredi (1891) found the general average of bacteria in street dust to be 716,521,000 while after dry weather it fell to 57,555,143. Mazuschita (1899) found general

averages in street dust of 589,857–1,204,948 reduced after 26 days of dry weather to 37,250–97,333. The most interesting of such experiments is that of Miquel who put house dust originally containing 740,000–760,000 bacteria away for 17 years and at the end of the time found that the number had fallen to 45,000–60,000.

This quantitative reduction is an important point to bear in mind in estimating the significance of such drying experiments as have been quoted above. The reduction of bacteria exposed to unfavorable conditions is always a gradual process, rapid at first and then very slow. It has been worked out in great detail for the life of pathogenic bacteria in water. Drying experiments have usually not been quantitative. Germano made a few counts but in most cases his quantitative data are too imperfect to give a measure of the rate of reduction. In one case however he gives the detailed counts tabulated below:

TABLE I.

Rate of Reduction of Diphtheria Bacilli in Dust.

(Germano, 1897.)

	Coarse Dust.	Fine Dust.
Control	400,000	500,000
1 day	16,000	25,000
2 days	14,000	17,000
5 days	Few	7,500
7 days	400	2,150
9 days	Few	1,300

In recent unpublished work by Abramson and the senior author it was found that when colon bacilli are dried in sand 99% perish in 24 hours while some persist for several weeks. This quantitative reduction may of course make the danger of infection from a practical standpoint negligible long before the last resistant minority of disease bacteria have disappeared. Bacteria which are completely eliminated in ten days or two weeks are probably 90% gone in a few hours.

II. PREVIOUS INVESTIGATIONS OF THE BACTERIOLOGY OF DUST.

The bacteriological examination of dust is closely connected on the one hand with the study of the bacteria in air and on the other hand with the investigation of fomites of all sorts for the detection of pathogenic bacteria. Air bacteria are in the main dust bacteria and the number of bacteria in the air varies with the amount of dust contained in it. Maxim-

ovitch (1894) quotes Tenon as finding a count of 1500–2000 bacteria per cubic meter of quiet hospital air raised to 466,000 after sweeping and cites an experiment by Hesse in which 2000 bacteria per cubic meter were present in the air of a class-room before the class arrived, while he found 15,000 during the hour and 35,000 just after the class had left. Russell (1899) found that in a cow stable 12,000–42,000 bacteria fell on a 12 inch plate while bedding was going on and only 483–2370 an hour afterward. J. A. Rockwell in an unpublished investigation carried out in 1896 in the laboratories of the Massachusetts Institute of Technology found a count of 56,300 bacteria per cubic meter in street air suddenly raised to 20,000,000 by a dust cloud. Many observers like Prudden (1890) have limited themselves to the study of the dust suspended in the air. We have not attempted in our survey of the literature to review investigations of this character, since on the qualitative side the isolation of pathogenic germs from the air has been confined to the pyogenic cocci except in a very few instances and since on the quantitative side the data obtained are not comparable with those derived from the study of deposited dust. We have confined ourselves to the studies which have been made of dust itself, either scraped up in bulk or wiped off from surfaces by the use of moist swabs. It is of course obvious that the bacteria may in some cases have been present on the surfaces or in the dust in question in a condition of incomplete dryness and this possibility cannot be entirely excluded.

So far as the isolation of specific pathogenes from dust is concerned, the results appear to be about what should be expected from the drying experiments cited above. The least resistant organisms, D. gonorrhoeae, B. influenzae, B. pestis and M. comma have never been isolated from dry dust. Zelenev (1895) claims to have found the microspira of cholera in one out of fifteen samples of dust swabbed from hospital tables in the cholera ward during an epidemic but if his organism really was M. comma it may, of course, have been recently deposited on the table in the form of fresh fecal pollution. With regard to the typhoid bacillus too, evidence of persistence in dust is almost entirely negative. Verdozzi (1908) quotes Kelsch and Simonin, Santori and Faelli, Sanglé Ferrierè and Remlinger as having isolated B. typhi from dust. Solovieff (1895) thought he found it in the dust of a hospital storehouse. So far as we are aware, however, no one has claimed to have done so in recent years and anyone familiar with the difficulties of separating the typhoid bacillus from related forms may well be sceptical as to any isolation not confirmed by serum reactions. Isolation of the colon bacillus from dust has been reported by Solovieff (1895), Kirchner (1896), Kelsch and Simonin (1898) and Kinyoun (1905) and our own results show that it is very abundant in both indoor and out door dust. Attempts to isolate the diphtheria organism have been more generally successful than in the case of typhoid fever. Weichardt (1900)

obtained three positive results in the examination of 300 swabs from sick rooms while 250 swabs from other parts of the house were all negative. Hill (1902) found 4 positive results out of 532 swabs from the neighborhood of the sick.

Kinyoun (1905) reports the isolation of B. diphtheriae from dust rubbed off from railway furniture. Renney (1905) obtained it from the dust on the top of a door. Chapin (1910) cites Richardiere and Tallemer as finding B. diphtheriae in the dust of a diphtheria ward, and Chapin himself reports negative results from 200 swabs. In all these investigations, except Renney's, the infection picked up by the swab may apparently have been rather fresh and not really in the form of dust.

Investigation in regard to the presence of the tubercle bacillus in dust have been carried out on an exhaustive scale by many observers, since Cornet first emphasized the danger of dust infection in this disease. The dust, collected in pincers or sterile spatulas, or swabbed off surfaces with sterile swabs, has usually been suspended in water and injected into guinea pigs. A considerable proportion of the animals so treated generally die within a few days as a result of pyogenic or septic bacteria in the dust and these animals must of course, be excluded from consideration. Another source of confusion lies in the fact that sometimes several animals are inoculated with one sample of dust while in other investigations a number of samples of dust are mixed for injection into a single animal. Thus the work of Hill (1902) is often quoted as indicating a very small proportion of positive results. It is said that he collected 676 swabs and obtained only 9 positive results; but as a matter of fact the 676 swabs were so mixed as to be injected into 59 guinea pigs of which 24 died of other infections. As a fact therefore 35 guinea pigs were really available for the test and 9 or 27% were tuberculous. To avoid this confusion we have tabulated the results obtained by the principal observers in the form on p. 673, showing first the total number of animals tested, second the proportion dying prematurely of diseases other than tuberculosis and third the proportion of the animals surviving these infections which later developed tuberculosis. This form of tabulation ignores entirely the number of samples examined but as the amount of dust used varied with the different investigators, and was quite indefinite with most of them, this is of no importance. Some idea of the amount of dust used may perhaps be gained from the mortality from other diseases, ranging from 10 to 60%. In making up our tabulation we have excluded all cases in which the diagnosis of the tubercle bacillus was made by microscopic examination only.

The results are on the whole remarkably concordant considering the chances for error in such work. The dust from the neighborhood of consumptive patients appears to give positive results in 20–50% of the animals infected, while in dust from places not specially

TABLE II.

Tubercle Bacilli in Dust from the Neighborhood of Tuberculous Patients.

Observer.	Source of dust.	Number of animals.	Percentage of animals dying of other infections.	Percentage of surviving animals dying of tuberculosis.
Hance, 1895	Sanatoria	90	10	7
Wagner, 1903	Hospital	40	10	8
Heymann, 1901	Hospitals and sick rooms	371	18	18
Zelenev, 1895	Hospital tables	39	13	26
Friberger, 1908	Clothing	33	42	26
Hill, 1902	Hospitals and sick rooms	59	44	27
Cornet, 1889	Hospitals	145	51	35
Coates, 1901	Clean infected houses	20	15	35
Cornet, 1889	Private sick rooms	170	54	43
Maximovitch, 1894	Hospital floors	21	19	53
Coates, 1901	Dirty infected houses	52	29	53

TABLE III.

Tubercle Bacilli in Dust Not Exposed to Pollution from Tuberculous Patients.

Observer.	Source of dust.	Number of animals.	Percentage of animals dying of other infections.	Percentage of surviving animals dying of tuberculosis.
Cornet, 1889	Dirty non-infected houses	77	40	0
Solovieff, 1895	Hospital store-rooms	57	40	0
Kelsch, Boisson, Bräun, 1898	Barracks	122	40	0
Coates, 1901	Dirty non-infected houses	20	30	0
Gotschlich (cited by Chapin, 1910)	Railway stations, etc.	119	?	0
Kinyoun, 1895	Railway cars	174	26	2
Heron and Chaplin, 1894	General hospitals	100	27	3
Petri, 1894	Railway cars	208	35	4
Manfredi, 1891	Street	82	48	7
Kirchner, 1895	Barracks	42	60	6
Hance, 1897	Tenements, cars, etc.	67	30	15
Prausnitz, 1891	Railway cars	20	20	31
Kirchner, 1896	Barracks	14	36	33

exposed to pollution the proportion of positive results is almost always under 10% and in two-thirds of the cases under 5%. The two high results reported by Prausnitz (1891) and Kirchner (1896) represent a very small number of animals (5 positive results in Prausnitz's case and 3 in Kirchner's). The comparative work of Cornet and Coates is particularly significant. Cornet found 43% of the animals which survived septic infection tuberculous in dust from rooms occupied by tuberculosis patients, 35% in dust from tuberculosis hospitals and none in various places not exposed to infection. Coates (1901) found 53% positive results in dirty infected houses, 35% in clean infected houses and none in dirty non-infected houses.

In dust from almost any source there is apparently more or less likelihood of finding some virulent tubercle bacilli. It is difficult to make any estimate of their quantitative distribution, however, since no record has been made by most observers of the amount of dust infected. Prausnitz (1891) suspended 400 mg. samples of dust from railway carriages in 10–15 cc. water and used 1 cc. for infection; 16 animals survived septic infections and 5 developed tuberculosis. This would indicate about one tubercle bacillus in 100 mg. dust. Verdozzi (1908) used 5 mg. samples of library dust and found tubercle bacilli in one sample out of 9. This would give one tubercle bacillus in 45 mg. dust. Le Noir and Camus (1909) found that they had to use 150 mg. of dust from a hospital ward to cause tuberculosis. So it is evident that B. tuberculosis may be present in dust from various sources to the number of five or ten to the gram.

The pyogenic cocci of various types have also been isolated from dust by numerous investigators. Germano (1897) and Chapin (1910) cite numerous cases in which both the aurococcus and the streptococcus have been found in air, and very many of the guinea pigs which died in the early days in the studies made to isolate tubercle bacilli from dust were infected with these organisms. Aurococci have been isolated from dust by Turina, 1890; Manfredi, 1891; Maximovitch, 1894; Solovieff, 1895; Zelenev, 1895; Kirchner, 1896; Mazza, 1897; Kelsch and Simonin, 1898; Mazuschita, 1899; Kinyoun, 1905; and many others; 5–10% of the animals injected usually showing infections of this type. Streptococci have been found in dust by the first five of the observers just quoted as finding the aurococcus; by Mazza, 1897; Ucke, 1897; Kelsch, Boisson and Braün, 1898; Kinyoun, 1905; and many others.

A number of bacteriologists report the finding of pneumococci in dust. Three Russians, pupils of Tchudnovsky's, all report finding this organism a number of times in dust from hospital floors, storehouses and tables (Maximovitch, 1894; Solovieff, 1895; Zelenev (1895). Netter (1897) isolated it twice from hospital dust and Mazza (1897) found it several times in dust from restaurants. Washbourn (1902) found it in dust from

a hospital ward and from a laboratory. Tirelli and Ferrari-Lelli (1903) found it in house dust and Kinyoun (1905) a number of times in dust from railway cars. There are, of course, many cocci more or less intermediate between the true D. pneumoneæ and the streptococci and all that most of these experiments mean is that the dust contained a diplococcus that behaved in general like the D. pneumoneæ. Many of them were probably related forms like those which gave the long periods of resistance to drying in Germano's and other experiments.

It is scarcely necessary to point out that spore bearing bacilli like the organisms which cause anthrax, tetanus and malignant œdema will survive drying for long periods and can be found at times in dust. For anthrax, Page (1909) cites Andrewes, who found anthrax spores in dust shaken out of a bale of Chinese hair, Webb and Duncan who found anthrax bacilli in two samples of dust shaken out from large quantities of hair, Stewart who isolated the bacillus from a Bombay hide and Eurich, who obtained negative results from 600 samples of clean wool, hair and dust, while 14% of the blood-stained specimens examined gave positive results. Page himself obtained negative results from 83 samples of bristles, hair and dust. Grusdeff (1891) reports anthrax in the dust from a railway car and Solovieff (1895) thought he found it in a hospital store-room. Manfredi (1891), Tirelli and Ferrari-Lelli (1903), Kinyoun (1905) and others have found the bacilli of malignant œdema in dust.

So far as non-spore forming pathogenic bacteria go there is convincing evidence of isolation from dust in the case of the diphtheria bacillus (a very few instances) the tubercle bacillus and certain cocci. Whether the latter should be called pathogenic or not is a question largely of terminology. If one calls everything pathogenic that kills an animal when injected under the skin, of course they are pathogenes. From the public health standpoint, however, such a use of the word is meaningless. Colon bacilli and aurococci are usually pathogenic in this sense, but they are normal inhabitants of the human skin and intestinal tract, they do not cause disease when inhaled or ingested and, except as indices of something else, have no significance as to the wholesomeness of the substance in which they are present. The streptococci and the diplococci, more or less closely resembling the pneumococcus, are in a somewhat different position. Some of these organisms undoubtedly do at times cause nose and throat diseases and others are harmless saprophytes of the nose and throat. We are not at present able to distinguish between the two types. The danger of transmission of disease bacteria in dust appears therefore to be confined to diphtheria, tuberculosis and certain obscure nose and throat diseases. Diphtheria bacilli are rarely present in dust, and tubercle bacilli and streptococci and diplococci rather commonly present, but it is not certain whether these streptococci

and diplococci (though virulent when injected into the body) are anything more than harmless saprophytes under ordinary condition of ingestion and inhalation. It should be noted that Neustaedter and Thro (1911) have recently produced anterior poliomyelitis by the injection of dust from a sick-room which thus apparently contained the unknown ultra-microscopic organism of that disease.

In contrast to these numerous studies of pathogenic forms in dust, determinations of the number of bacteria present, pathogenic or not pathogenic, have been few and far between. Tirelli and Ferrari-Lelli (1903) and Kinyoun (1905) made indirect determinations by stirring up the dust by sweeping, beating furniture, etc., aspirating the dusty air and studying its content. The Italian observers found numbers ranging between 118 and 20,352 per liter in one series and between 32 and 29,372 in another. Kinyoun in working with the dust stirred up from carpets in railway cars found 100 to 714 per liter. These figures are of course, however, only roughly quantitative since the dust beaten up into the air was uncertain in amount.

In another series of observations dust was swabbed off from a measured surface of floor, wall or furniture and the bacteria found expressed as so many per square meter. Petri (1894) examined the interior of railway cars of different classes and found the following results:

TABLE IV.

Bacteria in Dust on Surfaces in Railway Cars (Petri, 1894).

Number per Square Meter.

Class.	Floor.	Ceiling.	Walls, seats, etc.
I	258,300	3,900–24,200	4,600– 44,900
II	434,700	100	2,900– 55,900
III	548,100	300–1,100	5,900–280,000
IV	1,262,400	1,000	16,100– 26,460

The three Russian observers, Maximovitch (1894), Solovieff (1895) and Zelenev (1895) found considerably higher numbers in their studies of hospital dust as indicated in the table on p. 677; and this is not surprising in view of the infrequent cleaning which they describe as being in force at the hospital studied.

Actual quantitative determinations of the number of bacteria in a given weight of dust began with Miquel, who used the dilution method for studies of this kind in the very early days of bacteriology. In dust deposited on a paper in the library at Montsouris (Miquel 1881), he

TABLE V.

Bacteria in Dust on Surfaces in Russian Hospitals.

Number per Square Meter.

Observer.	Source of dust.	Minimum.	Maximum.	Average.
Maximovitch, 1894...	Floor of wards.....	11,310,000	34,340,000	22,750,000
	Floor of corridors.....	30,490,000	289,640,000	158,830,000
	Floor of toilets.....	29,080,000	52,720,000	35,900,000
Solovieff, 1895.....	Clothing store-room 1, shelf	69,740,000	246,270,000	167,435,000
	" " 2, "	160,800,000	579,200,000	411,800,000
	" " 3, "	35,600,000	109,470,000	87,535,000
	" " 1, floor	74,140,000	155,470,000	123,103,000
	" " 2, "	160,270,000	352,800,000	273,475,000
	" " 3, "	5,340,000	90,540,000	72,824,000
Zelenev, 1895.....	Hospital tables, painted...	3,760,000	20,746,000	9,260,000
	Hospital tables, oilcloth...	17,492,000	138,266,000	55,640,000

found 740,000 and 760,000 bacteria per gram and twice as many other organisms (molds, etc.) capable of forming a surface growth on broth (Miquel, 1897). In rooms at Paris he found 1,300,000 and 2,100,000 bacteria per gram in similar samples, (Miquel 1883); and it is interesting to note that he was impressed with the large proportion of cocci present (25% at Montsouris, 60% and 75% in the Paris samples). Earth showed a much smaller proportion, only 5% (Miquel, 1881). Later determinations of the bacteria in house dust have been made by several Russian and Italian observers. Maximovitch (1894) records 66,130,000 per gram in the dust from the floor of a hospital corridor. Mazza (1897) found 1,580,000, 1,950,000, 2,060,000, 2,520,000 and 3,170,000 bacteria per gram in the dust of five different coffee-houses. Maréchal (1906) reports very high numbers in nine samples of vacuum cleaner dust. Individual counts for bacteria ranged between a minimum of 642,857 and 11,000,000,000 and averaged 2,023,000,000; for molds, the minimum was 71, 428, the maximum, 4,333,333,333, and the average, 1,297,000,000 per gram. Verdozzi (1908), on the other hand, examined four samples of vacuum cleaner dust from the Biblioteca Angelica in Rome and found, respectively, 90,000, 170,000, 673,000 and 1,814,000 bacteria per gram. Most of the organisms present were spore forming rods, the cocci coming next in abundance. The very high counts obtained by Maréchal are so remarkable as to excite the suspicion of possible analytical error. Delay in plating after the suspension of the dust in water might easily lead to a multiplication which would give excessively high numbers.

Street dust, or street sweepings, has also been studied by several observers from the quantitative standpoint. Uffelmann (cited by Manfredi, 1891) found 2,000,000 to 40,000,000 bacteria per gram in street sweepings at Rostock and 8,000 to 12,840,000 (average, 3,000,000) at Monaco. Manfredi himself in the examination of sixty samples of street dust at Naples found a general average of 716,521,000 per gram, with a maximum of 6,688,000,000 and a minimum of 910,000. A surprisingly small proportion of these organisms were spore formers. The average for this group was 190,000 with a maximum of 4,500,000 and a minimum of 750. After a long period of dry weather the average for total bacteria fell to 57,555,143 with a maximum of 160,000,000 and a minimum of 910,000. Mazuschita (1899) made a careful study of the dust in sixteen streets, eight of which were sprinkled and eight were not. The averages or each of the sixteen streets are given below:

TABLE VI.

Bacteria in Street Dust (Mazuschita, 1899).

Number per Gram.

Sprinkled streets	1,945,750	56,000	2,211,500	180,000	281,000	97,333	4,697,333	170,666
Unsprinkled streets	1,563,750	192,666	1,825,000	112,500	70,000	37,250	440,500	84,000

The general average for the sprinkled streets was 1,204,948 and for the unsprinkled streets, 589,857. After 26 days of dry weather the numbers fell to 97,333 for the sprinkled streets and 37,250 for the unsprinkled. Ernst (1900) records the low value of 80,000 per gram for one sample of street dust.

III. METHODS USED IN THE PRESENT INVESTIGATION.

Over 150 samples of dust were obtained for our investigation from a considerable variety of sources, indoors and outdoors, within the limits of the city of New York. In general the samples may be classed under four heads, street dust, house dust, school dust and vacuum dust. The street dust was collected from sidewalks or pavements, the house and school dusts from shelves, tops of furniture and from the floor, the vacuum dust from the second dust chamber of the vacuum cleaner used in exhibition halls and store rooms of the American Museum of Natural History. The street dust obviously included two principal elements, inorganic and organic. The heavy mineral portion was made up of sand and other detritus from the grinding up of pavements and soil, ashes and the detritus produced from stone, plaster, cement, iron and other building materials. The or-

ganic portion was largely pulverized horse droppings and showed the fragments of seeds and vegetable matter characteristic of such material.

The house and school dusts were much lighter and made up either of very finely divided particles or of fuzzy fibrous masses apparently including textile debris. The vacuum dust was similar to the shelf and furniture dusts.

Samples were collected in small sterile test tubes. When dust was abundant, as in the street, the tube was used as a scoop. When the dust was scanty, as on shelves and furniture, it was brushed into the tube by the use of the sterile cotton plug with which the tube had been closed. Samples varied in amount from .1 gram to several grams.

From each sample a portion, varying from .1 gram to 1 gram, was weighed out on sterile filter paper, thoroughly shaken up in sterile water and diluted for plating in the usual manner. There must of course be a considerable sampling error in this process and the final results show only those bacteria which were separated from the dust particles.

The numbers of bacteria were determined by plating on standard lactose agar, made up with meat, 1 per cent pepton and 1 per cent lactose and adjusted to a reaction neutral to phenolphthalein; 20° counts were made after five days and 37° counts after two days. These plate counts were checked on 22 samples by determining total numbers at 20° by a dilution method, as it was thought that dried bacteria might in some cases fail to develop on solid media. One per cent lactose broth was used for this purpose and was inoculated with each decimal dilution from $\frac{1}{10{,}000}$ gram to $\frac{1}{10{,}000{,}000}$ gram. For determining the number of aerobic spores the same liquid dilution method was used, the tubes being heated at 175°–180° for ten minutes to destroy vegetative cells. Liquid cultures were kept at 20° for seven days unless growth appeared sooner.

Aside from this determination of spore formers quantitative tests were made for two special types of organisms as indicators of intestinal and buccal pollution. For the former the colon bacillus was used although it must be understood that since the colon bacillus is found in the feces of the horse it is equine, and not human, pollution that is indicated by this organism in city dust. For determining the colon bacillus the presumptive test in lactose bile was used. Numerous investigations made in the study of water bacteriology have shown that the results of this test coincide closely with those obtained by more elaborate methods and it is quite useless to carry out the old process of separation and identification except in special studies of an elaborate nature. In our work the test for the colon bacillus was made by inoculating three tubes of 1 per cent lactose bile with each of three centesimal dilutions, usually of $\frac{1}{100}$, $\frac{1}{10{,}000}$ and $\frac{1}{1{,}000{,}000}$ gram. Tubes showing gas production after seventy-two hours at 37° were considered positive. If a single tube only was positive in the $\frac{1}{100}$ dilution the

number of colon bacilli was recorded as 33 per gram, and similar records were made for the higher dilutions.

For a test of mouth pollution the acid forming streptococci were used. The whole group of the streptococci is characteristically parasitic in origin (Winslow and Winslow, 1908), being commonly found in the mouth and intestine of warm-blooded animals and in other habitats, only as they are polluted with human and animal discharges. The significance of the lactose fermenting streptococci, in particular, has been well established. In water (Prescott and Winslow, 1908) and shellfish (Clark, 1906) these organisms are usually found only in the presence of fecal pollution. Their special importance for our purpose lies in the fact that as shown by Andrewes and Horder (1906) and Winslow and Palmer (1910) they are rare in the feces of the horse. While colon bacilli are common to human, bovine and equine feces, and acid-forming streptococci are found abundantly in the human throat and in human and bovine feces the common streptococci of horse feces do not attack lactose. In the study of city dust, therefore, these organisms may be used to differentiate pollution from the human mouth from that derived from horse droppings. Gordon (1903) found streptococci capable of fermenting lactose present in from one-millionth to one-hundred-millionth of a cubic centimeter of saliva. The commonest form was Str. brevis which clots milk, forms acid in dextrose and lactose broths, does not liquify gelatin, grows better at 37° than at 20° and is non-virulent. In a long series of experiments he found only two tests out of 168 for acid-forming streptococci positive in the air of a quiet room where speaking had not been going on while at various points around a person speaking or reading with vigorous enunciation 68 out of 168 tests were positive. Outdoor air in London showed acid-forming streptococci in only one out of 10 50-liter samples while 7 of them contained the non-acid forming streptococcus characteristic of horse feces. Five broth plates exposed for an hour and a half gave the acid-former twice and the other type four times. In country air 11 samples totalling 1000 liters gave no acid-forming streptococci and 2 of the non-acid type and 13 broth plates gave only 3 acid-formers. Andrewes (1907) reviews the results of his own and Gordon's studies of air streptococci and shows that of 64 recorded strains 65% were of the Str. brevis type. It seems clear from this work and from all that we know of the habitat of the lactose-fermenting streptococci that when found in city dust these organisms may be taken to be indicators of bucal pollution from human beings.

In our own work fifty samples of dust were examined for these acid-forming streptococci. Plates were made for this purpose on litmus-lactose-agar at 37° and suspicious colonies were fished and subcultured. At the same time that the original plates were made lactose broth tubes were inoculated with decimal dilutions from $\frac{1}{1000}$ gram to $\frac{1}{100.000}$ gram and

incubated at 37° for three days to allow the streptococci present to overgrow other forms producing less acid. After three days, if the direct plates had not yielded streptococci, litmus-lactose-agar plates were streaked from the lactose broth tubes and this method sometimes yielded streptococci which were overgrown on the plates. Even so, however, streptococci must no doubt often have been lost and no attempt was made to find them in portions larger than $\frac{1}{1000}$ gram. Negative results do not mean, therefore, that no streptococci were present; but only that none were isolated from $\frac{1}{1000}$ gram portions. All the cultures isolated were examined under the microscope and cultivated on litmus-lactose-agar slants to observe the acid production and habit of growth. Only those forms were considered positive which showed spherical cells occurring in chains of at least four elements and which produced the characteristic veil-like or scanty growth on lactose agar and strongly acidified the medium. The microscopic examination often showed variations in form from true cocci to elongated oval forms but this is always characteristic of the mouth cocci shortly after isolation. Again it must be understood that by "streptococci" we do not mean that the organisms occurred in long coiled chains with no other groupings. Sometimes this was the case, and one culture showed all the morphological and growth characters of the Streptococcus conglomeratus of Kurth. Usually, however, there were pairs and more or less irregular groups, as well as chains, although the tendency to chain formation was always clearly present. This again is characteristic of the mouth streptococci and the term "streptococcus" is applied by us to organisms having such morphology combined with meager surface growth and strong acid production in the sense in which it is used by Winslow and Winslow in the "Systematic Relationships of the Coccaceae."

In order to be sure of the acid producing power of the streptococci, we checked the somewhat uncertain litmus reaction by cultivating 34 of the strains, isolated from 27 samples, in lactose broth for three days at 37° and determining the amount of acid produced by titrating two duplicate tubes of each, using phenolphthalein as an indicator and subtracting the acidity of inoculated controls. The results are shown in the table below and they indicate that all the cultures tested belonged to the lactose-fermenting class.

TABLE VII.

Acid Production of 34 Strains of Dust Streptococci in Lactose Broth.

Acidity classes, per cent. normal acid produced	1.6–2.0	2.1–2.5	2.6–3.0	3.1–3.5	3.6–4.0	4.1 and over.
Number of strains in each class	5	8	7	8	4	2

IV. RESULTS AS TO THE NUMBER AND KINDS OF BACTERIA IN NEW YORK CITY DUST.

Total Counts on Plates at 20°. The total counts obtained by plating on lactose agar at 20° are shown in the fourth column of Tables VIII–XI and in Diagrams I and II. Individual counts range from 150,000 bacteria per gram (sample 17 from a window sash in the library of the American Museum) to 145,000,000 (sample 95, street dust from the corner of Grand and Essex Streets). The indoor dusts (house, school and vacuum) were generally under 20,000,000, the street dusts usually over 20,000,000 (see Diagram II). The average for house dusts was 5,500,000, for vacuum dusts

TABLE VIII.

Bacterial Content of School and Museum Dusts.

No. of sample.	Source.	Date.	Bacteria per gram.		
			Agar 20°.	Agar 37°.	B. coli.
3	College Corridor 3rd floor	18–2–11	170,000	———	4,000
5	College concourse	4–3–11	1,500,000	800,000	60,000
17	Museum library window sash	14–6–11	150,000	300,000	33
18	Museum corridor case. (E. hall)	"	350,000	330,000	100
19	Lab. shelf dust	"	350,000	———	100
20	Tops of case Museum	15–6–11	6,000,000	290,000	100
21	Museum basement case	"	8,500,000	510,000	66
22	Museum basement case	"	4,000,000	210,000	3,300
23	Museum basement pipe	"	12,000,000	190,000	3,300
24	Museum basement on stone block	19–6–11	5,000,000	285,000	0
25	College class room on top of case	"	2,000,000	2,000,000	100
26	College class room on top of case	"	2,500,000	1,000,000	33
27	Settlement window sill	"	6,000,000	———	33
28	Settlement window sill	"	9,000,000	3,500,000	100
29	Settlement picture frame	"	18,000,000	5,000,000	100
30	Settlement picture frame	"	10,000,000	5,000,000	100
31	Settlement moulding	"	15,000,000	3,000,000	100
36	School room shelf and window dust	27–6–11	500,000	150,000	33
37	Assembly hall shelf dust	"	1,700,000	700,000	33
38	Assembly hall, top of closet	"	8,000,000	1,100,000	0
39	Assembly hall window sash	"	6,000,000	1,400,000	66
40	Class room shelf	"	45,000,000	4,000,000	66
41	Class room picture frame	"	7,000,000	2,200,000	100
42	Class room moulding	"	2,500,000	3,500,000	0
43	Class room 3rd floor	"	2,500,000	2,500,000	0
44	Class room window	"	450,000	———	0
45	Class room window	"	1,500,000	2,500,000	0

Diagram I.—Distribution of samples of Dust from Streets, Houses, Schools, and Vacuum Cleaner, according to their content of bacteria at 20° and 37° and their content of colon bacilli and streptococci.

TABLE VIII—*Continued.*

Bacterial Content of School Dusts.

No. of sample.	Source.	Date.	Bacteria per gram.		
			Agar 20°.	Agar 37°.	B coli.
46	Class room window (different school)	30–6–11	1,000,000	500,000	66
47	Moulding, class room	"	2,000,000	1,000,000	100
48	Shelf, class room	"	700,000	600,000	100
49	Chandelier, class room	"	200,000	1,000,000	33
50	Top of closet	"	350,000	500,000	100
51	Moulding	"	200,000	150,000	100
52	Window	"	300,000	100,000	0
53	Top of book case	"	350,000	500,000	100
54	Picture frame class room	"	250,000	350,000	100
55	Hall picture frame	"	5,500,000	950,000	6600
56	Book case, class room	5–7–11	400,000	250,000	100
57	Door cornice	"	3,500,000	230,000	66
58	Statuette, Assembly hall	"	1,500,000	240,000	100
59	Hall picture frame	"	400,000	230,000	100
61	Class room picture frame	"	2,000,000	500,000	66
12	College window outside	"	11,500,000	20,000,000	0
	Average		4,790,000	1,730,000	1,850

3,730,000, for school dusts 4,790,000, and for street dusts 49,200,000. Of course the variation between individual samples of dust is naturally very great. There appears to be a tendency to seasonal variation, the samples collected in warm weather showing higher numbers, but our data are not sufficient to show this definitely.

These results harmonize well with those obtained by Miquel, Maximovitch, Mazza, Verdozzi, Uffelmann, and Mazuschita, cited above. The figures given by Maréchal and Manfredi are very much higher.

Total Counts by Liquid Culture Method. Bacteria from dry substances are apt to develop slowly on plates, and it occurred to us that some might not develop at all, which were still capable of multiplication in ordinary liquid media. We therefore made check determinations by the plate method and the dilution method with a special series of 21 samples with the results shown in Table XII and Diagram III. The first six samples were the same ones listed under corresponding numbers in earlier tables after storage in the laboratory for a period of about three to six months. Five of them, for which comparable data are available, show a drop in total count from an average of 9,000,000 to an average of 1,360,000, indi-

cating a gradual decrease on standing. The other fifteen samples were fresh samples collected for this purpose and not included in Tables VIII–XI or Diagrams I and II. If they had been included they would have lowered the figures somewhat, for the nine indoor dusts had an

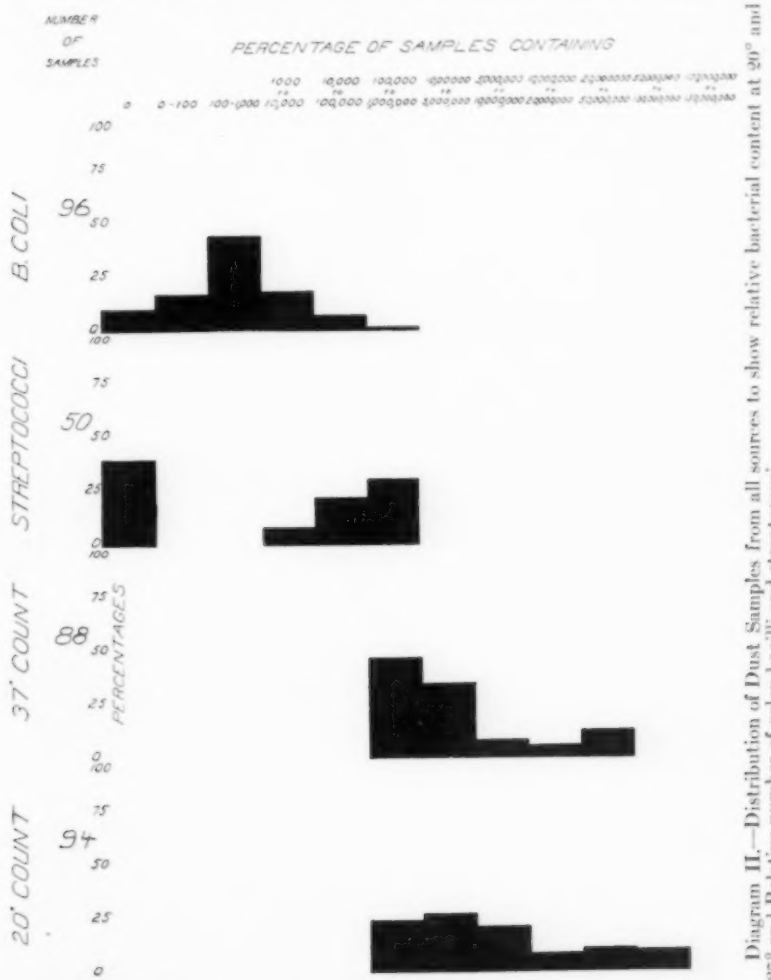

Diagram II.—Distribution of Dust Samples from all sources to show relative bacterial content at 20° and 37° and Relative number of colon bacilli and streptococci.

average of 760,000 bacteria per gram and the outdoor samples 4,700,000. These samples were collected in cold winter weather and, as noted above, winter dusts are perhaps lower in numbers than summer dusts. The general results of the comparison of the plate and dilution methods are best shown in Diagram III. The vertical lines show the contents of each sample by each method, the middle line for each sample indicating the liquid

Diagram III.—Relative number of Spores and Total Bacteria, in Dust, determined by Plating and by a Liquid Culture method. Plotted on a Logarithmic Scale.

method and the right hand line the plate count. It must be noted that the scale is a logarithmic one so that the actual differences are much greater than appear to the eye. The relative relations are clear however. Out of 21 samples the plate count showed more bacteria than the liquid method in all but four instances. Sample 99 showed the same number and samples 100, 101 and 103 showed a higher count by the liquid method. The average of the 21 samples gave 1,920,000 by the plate method and 830,000 by the liquid method. This is about what should be expected if both the methods were accurate so far as experimental conditions go, for in the liquid method if growth occurs in the millionth dilution and not in the ten-millionth we call the number present one million whereas it is somewhere between one million and ten million. We may conclude at any rate that the plate count is reasonably accurate and gives a fair idea of the total number of bacteria capable of development on either solid or liquid media of the ordinary type and under ordinary conditions of incubation.

TABLE IX.

Bacterial Content of Vacuum Dusts.

No. of Sample.	Source.	Date.	Bacteria per gram.		
			Agar 20°.	Agar 37°.	B. coli.
66	Vacuum, Museum lecture hall	9–8–11	550,000	690,000	100
67	Vacuum, Museum lecture hall	"	6,000,000	350,000	100
68	Vacuum, Museum lecture hall	"	7,000,000	3,500,000	100
69	Vacuum, Museum lecture hall	"	2,000,000	240,000	100
70	Vacuum, Museum lecture hall	"	12,000,000	2,500,000	100
71	Vacuum, Museum Paleontology Dept.	9–16–11	1,500,000	10,000,000	100
72	Vacuum, Museum Paleontology Dept.	"	1,500,000	15,000,000	100
73	Vacuum, Museum Paleontology Dept.	"	9,000,000	1,000,000	100
74	Vacuum, Museum Paleontology Dept.	"	8,000,000	———	100
75	Vacuum, Museum Paleontology Dept.	"	600,000	700,000	100
85	Vacuum, Museum rug	10–13–11	280,000	220,000	100
86	Vacuum, Museum rug	"	2,000,000	2,000,000	100
87	Vacuum, Museum rug	"	1,500,000	430,000	100
88	Vacuum, Museum rug	"	250,000	240,000	100
	Average		3,730,000	2,850,000	100

TABLE X.

Bacterial Content of House Dusts.

No. of Sample.	Source.	Date.	Bacteria per gram.		
			Agar 20°.	Agar 37°.	B. coli.
1	Dining room floor	18-2-11	1,200,000	———	100
8	Bed room, window sill, inside	6-4-11	9,000,000	300,000	33
9	Book case shelves	"	1,100,000	780,000	100
10	Side board	"	6,200,000	490,000	3,300
11	Dining room shelf	"	11,000,000	1,000,000	6,600
13	Window sill outside, (back)	———	27,000,000	9,000,000	100
14	Front window sill outside	———	8,000,000	3,600,000	0
15	Window sill, inside	14-6-11	9,900,000	650,000	100
16	Shelf dust	"	1,500,000	540,000	3,300
32	Moulding	24-6-11	1,500,000	300,000	66
33	Moulding	"	1,000,000	470,000	100
34	Picture frame	"	700,000	300,000	33
35	Blown in through window on a polished surface	"	3,500,000	20,000,000	66
63	Moulding	5-7-11	380,000	270,000	100
64	Picture frame	"	490,000	———	100
	Average		5,550,000	2,900,000	940

Number of Aerobic Spores. The number of aerobic spores present was determined by the dilution method for the special series of 21 samples just discussed and the results are shown in Table XII and Diagram III. Comparison of the fourth and fifth column in Table XII and of the left-hand and middle lines in Diagram III show that spores capable of resisting heating to 175°–180° for ten minutes formed in most samples about one-tenth of the total bacterial flora. In seven of the 21 samples exactly this relation obtained while in nine cases there were less than one-tenth* and in five cases the spore count was the same as the count before heating or even higher. Of course the latter results are due to the experimental errors of distribution inherent in the dilution process. It may be concluded that one-tenth or less of the bacteria in city dust are spore formers and that the high total numbers found must be accounted for mainly by the persistence under dry conditions of vegetative cells. Manfredi found a still smaller proportion of spore formers.

*The spore values for samples 99, 100, 102 and 103 are plotted in Diagram III as 10,000 but actually the $\frac{1}{10,000}$ dilution was negative and no lower dilutions were tested.

TABLE XI.

Bacterial Content of Street Dusts.

No. of Sample.	Source.	Date.	Bacteria per gram.		
			Agar 20°.	Agar 37°.	B. coli.
2	Subway Station, 135th St., near exit	18–2–11	7,000,000	———	6,000
4	Street, 145th St., and St. Nicholas Ave.	4–3–11	48,000,000	1,000,000	40,000
6	155th St., bridge across Harlem River	9–3–11	40,000,000	150,000	6,000
7	Gutter, front of main entrance to College	9–3–11	54,000,000	500,000	20,000
65	Street dust	8–9–11	———	45,000,000	330,000
76	Sidewalk dust	29–9–11	90,000,000	15,000,000	6,600
77	81st St., and Central Pk., cor. of Fifth Ave	"	83,000,000	40,000,000	100
78	81st St., and Cent. Pk., middle of block	"	100,000,000	28,000,000	10,000
79	Fifth Ave., and 83rd St.	"	30,000,000	4,500,000	100
80	Central Park Driveway at entrance near 5th Ave.	"	8,000,000	2,000,000	100
81	Brook Ave., near 169th St.	"	1,500,000	6,000,000	660,000
82	169th St.	"	15,000,000	3,200,000	3,300
83	Sidewalk Central Pk., W. and 81st St.	13–10–11	27,000,000	8,600,000	33,000
84	Sidewalk Cent. Pk. W., and 79th St.	"	22,000,000	6,500,000	66,000
89	Houston St.	4–11–11	54,000,000	40,000,000	6,600
90	Broadway and 79th St.	"	22,000,000	9,000,000	100
91	79th Street	"	7,000,000	8,000,000	10,000
92	Mixed Sample	"	52,000,000	36,000,000	3,300
93	Allen and Canal St.	10–11–11	22,000,000	16,000,000	6,600
94	Canal and Bowery	"	20,000,000	23,000,000	6,600
95	Grand and Essex Sts.	"	130,000,000	77,000,000	100
96	East Broadway, Seward Park	"	———	16,000,000	3,300
97	Chrystie and Grand Sts.	"	106,000,000	47,000,000	3,300
98	Essex and Grand Sts.	"	145,000,000	90,000,000	6,600
	Average		49,200,000	22,700,000	51,100

TABLE XII.

Comparative Numbers of Bacteria by Plate Method and Liquid Method, and Numbers of Spores, in Dust.

No. of Sample.	Source.	Date of Inoculation.	Bacteria per gram. 20°. Liquid Method. Total.	Liquid Method. Spores.	Plate Method.	37°.
54	School dust	27-1-12	1,000,000	10,000	———	100,000
67	School dust	"	100,000	1,000,000	600,000	2,000,000
69	School dust	"	100,000	10,000	300,000	300,000
73	School dust	"	100,000	10,000	300,000	1,600,000
74	School dust	"	100,000	1,000,000	600,000	500,000
94	Street dust	"	1,000,000	10,000	5,000,000	4,500,000
99	Window sash, library A. M. N. H.	1-2-12	100,000	10,000	100,000	100,000
100	House dust, shelf	"	1,000,000	10,000	500,000	400,000
101	Heavy vacuum	"	10,000,000	10,000	1,400,000	200,000
102	Light vacuum	"	100,000	10,000	1,300,000	300,000
103	House dust, top of gas meter	"	1,000,000	10,000	130,000	200,000
104	Light dust, attic of A. M. N. H.	10-2-12	100,000	10,000	1,800,000	200,000
105	Light vacuum	"	100,000	10,000	450,000	200,000
106	Street dust	"	100,000	10,000	6,900,000	1,700,000
107	Street dust	"	1,000,000	10,000	14,500,000	1,200,000
108	Sidewalk dust	"	100,000	10,000	1,900,000	200,000
109	House window sill, bed room inside	17-2-12	100,000	100,000	500,000	200,000
110	Window sill, parlor inside	"	100,000	1,000,000	650,000	150,000
111	Street dust, 78th St. and Columbus Ave.	———	1,000,000	100,000	2,100,000	150,000
112	Sidewalk, 77th St.	———	100,000	1,000,000	1,000,000	150,000
113	Sidewalk dust, 77th St.	———	100,000	1,000	350,000	100,000
	Average		830,000	205,000	1,920,000	688,000

Number of Bacteria Developing at Body Temperature. The number of bacteria developing an lactose-agar plates at 37° varied from 100,000 per gram for sample No. 52 (window sill of a school) to 90,000,000 for sample No. 98 (street dust). The indoor dusts were usually between 100,000 and 5,000,000 and over one-half of them were under one million, while 90% of the street dusts showed more than one million and about 40% over 20 million. The average was between one and three million for the indoor dusts and about 23,000,000 for the street dusts. These figures are just about half as great as the counts obtained at 20° and this fact seems to us somewhat significant as a probable indication that the bacteria in city dust are largely of buccal and intestinal origin. MacNeal, Latzer and Kerr (1909) found the ratio of 37° and 20° counts for human feces to be about 90%. For Boston sewage it was found to be 73% (Winslow, 1905), while for unpolluted waters it is usually under 10% (Prescott and Winslow, 1908).

Number of Bacteria of the B. coli Group. The number of bacteria of the B. coli group was determined by the standard lactose-bile test incubating for 72 hours at 37° and calling all gas producers positive. Organisms of this type were usually present. All of the 24 street dusts showed positive results in $\frac{1}{10}$ gram or less, and about 80% had over 1000 colon bacilli per gram. Two samples showed 330,000 and 660,000 respectively. Of the indoor dusts, 9 out of 72 gave negative results in three duplicate $\frac{1}{10}$ gram samples. In most cases (39 out of 72) the numbers ranged between 100 and 1000 per gram and in 8 out of 72 samples there were over 1000 present. The maximum was 60,000. The average numbers for indoor dusts lie between 1000 and 2000 and for street dusts the average was 51,000.

It seems well established that the chief primary source of gas producing bacilli of this type is the alimentary canal of man and other warm-blooded animals and the considerable numbers of colon bacilli found are probally indicative of fecal pollution. It is obvious on microscopic examination that a good deal of street dust is ground up horse manure and this is presumably the chief origin of the colon bacilli found. It may be noted that the ratio of colon bacilli to total bacteria was 1 in 963 in the street dusts and only 1 in 3582 in the house dusts and this is what would be expected if the colon bacilli came from horse manure in the street and if the house dust is derived partly from the street and partly from internal sources.

Number of Acid-forming Streptococci. Aside from the horse droppings in the street, the principal source of pollution for city dust might naturally be looked for in the discharge of the sputum and mouth spray of human beings. The group of lactose fermenting streptococci may serve as a convenient index of pollution of this sort as we have pointed out above.

For the study of acid-forming streptococci in dust we used a special

TABLE XIII.

Streptococci in House Dust.

No. of Sample.	Source.	Date.	Acid-forming streptococci per gram of dust.
109	Window sill, bedroom inside	17-2-12	10,000
110	Window sill, parlor inside	"	<1,000
114	Window sill, bath room outside	21-2-12	<1,000
136	Carpet dust, dining room	1-3-12	10,000
143	General house dust collected by means of a vacuum	3-3-12	<1,000
146	House dust collected by a vacuum cleaner	"	100,000
	Average		20,000

TABLE XIV.

Streptococci in School Dust.

No. of Sample.	Source.	Date.	Acid-forming streptococci per gram of dust.
104	Attic A. M. N. H.	10-2-12	<1,000
105	Light vacuum A. M. N. H.	"	<1,000
115	Class room, floor dust	21-2-12	100,000
116	Toilet window sill in school	"	100,000
117	Class room window sill facing street	"	<1,000
118	Railing over clerk's office, school	"	100,000
119	Class room, top of closet	"	<1,000
120	Gas fixtures, school class room	"	1,000
121	Top of closet, class room	"	10,000
122	Window sash, class room facing court	"	<1,000
123	Class room floor	"	10,000
134	Picture frame, settlement room	1-3-12	<1,000
135	Window sash, College stairs	"	<1,000
137	Railing clothes closet, school room, 2 weeks old	"	<1,000
138	College hall, top of files	"	<1,000
139	Alcove dust, College	"	10,000
140	Tops of closet, settlement room	"	<1,000
141	Alcove dust, college	"	100,000
142	Window sash, college class room	"	<1,000
	Average		22,700

TABLE XV.

Streptococci in Street Dust.

No. of Sample.	Source.	Date.	Acid-forming streptococci per gram.
106	Street gutter	10–2–12	100,000
107	169th St.	"	100,000
108	169th St., sidewalk	"	100,000
111	78th St., and Columbus Ave., gutter	11–2–12	<1,000
112	77th St., sidewalk	"	<1,000
113	77th St., and Columbus Ave	"	<1,000
124	Brook Ave.	"	10,000
125	Brook Ave., and 169th St., gutter	"	10,000
126	8th Ave., and 135th St.	"	1,000
127	Lenox Ave., and 125th St.	"	10,000
128	7th Ave., and 131st St.	"	100,000
129	125th St. and 3rd Ave.	"	<1,000
130	134th St., and 7th Ave., cor.	"	10,000
131	125th St., gutter	"	100,000
132	Third Ave., and 149th St., gutter	"	1,000
133	7th Ave., and 135th St.	"	10,000
144	East Broadway	3–3–12	100,000
145	Chrystie and Canal Sts.	"	<1,000
147	Amsterdam Ave., and 78th St.	"	<1,000
148	Allen and Canal Sts., gutter	"	100,000
149	Jefferson and East Broadway, gutter	"	10,000
150	77th St., near Columbus, gutter	"	100,000
151	Henry and Clinton Streets	"	100,000
152	Canal St., sidewalk	"	1,000
153	Canal St., and Eldridge	"	100,000
	Average		42,500

TABLE XVI.

Average Bacterial Content of Various Dusts.

Type of dust.	Bacteria per gram. Lactose agar 20°.	Lactose agar 37°.	B. coli.	Streptococci.
Street	49,200,000	22,700,000	51,100	42,500
House	5,500,000	2,900,000	940	20,000
Vacuum	3,730,000	2,850,000	100	——
School	4,790,000	1,730,000	1,850	22,700

series of 50 samples collected during the winter of 1911–1912. Twenty-five were street dusts, six house dusts and nineteen school dusts. Several vacuum-cleaner samples are included in each of the latter groups as they were not enough to make a special class.

No tests were made in dilutions corresponding to amounts larger than $\frac{1}{10000}$ gram. Of the 25 indoor dusts (see Tables XIII and XIV and Diagram II) 14 gave negative results in the $\frac{1}{10000}$ dilution; one was positive in $\frac{1}{10000}$ gram, 5 in $\frac{1}{100000}$ gram and 5 in $\frac{1}{1000000}$ gram. The average for all indoor samples (considering those negative in $\frac{1}{10000}$ dilutions as having no streptococci) was 22,040 per gram. Of the 25 street dusts (see Table XV), six were negative in the $\frac{1}{10000}$ dilution, three showed 1000 per gram, 6 showed 10,000 and 10 showed 100,000 or more. The average for the whole series was 42,500 per gram. The ratio of specific polluting organisms to total bacteria is particularly significant. While colon bacilli were relatively most abundant in the street dusts (1 in 963 against 1 in 3582 for indoor dusts), there was one acid-forming streptococcus out of 1157 bacteria in the street dusts and one out of 215 in the indoor dusts. This seems to indicate that, as might be expected, the colon bacilli come mainly from horse droppings in the street, while the streptococci come mainly from the human mouth.

V. SUMMARY AND CONCLUSIONS.

1. The total number of bacteria in city dust as determined by plating on lactose agar at 20° is high, ranging from 150,000 to 145,000,000 per gram. There is a marked difference between street dusts and those collected indoors. Street dusts were found to be usually over 20,000,000 and 24 samples averaged 49,200,000. The 72 indoor dusts were usually under 20,000,000 and averaged between 3 and 5 millions.

These results correspond closely with those obtained by Miquel (1881), Maximovitch (1894), Mazza (1897), and Verdozzi (1908) for house dust, and by Uffelmann and Mazuschita (1899) for street dust. Maréchal (1906) and Manfredi (1891) report much higher results and Ernst (1900) one very low one.

2. Spore forming aerobes usually make up only one-tenth or less of the total.

3. The number of bacteria developing at body temperature is about half that obtained by plating at 20°. The indoor dust showed usually between 100,000 and 5,000,000 with an average between one and three million. About half the street dusts showed over twenty million and all of them averaged 23 million.

4. All the street dusts and all but nine out of 72 indoor dusts showed colon bacilli, at least 33 per gram. In two street samples the numbers rose to 330,000 and 660,000 per gram, respectively, while the largest indoor

result was 60,000. The average for the indoor dusts was between 1,000 and 2,000 per gram and for the street dusts over 51,000. The ratio of colon bacilli to total bacteria was 1 in 963 for the street dusts and one in 3582 for the indoor dusts, indicating that as might be expected the origin of the colon bacilli is mainly the horse droppings in the street. The high results may help to explain the increase of colon bacilli sometimes noted in city reservoirs exposed to pollution from street dust.

5. Acid-forming streptococci, of the type characteristic of the human mouth and intestine, but not abundant in horse feces, were isolated from 11 out of 25 indoor samples and from 19 out of 25 street samples in dilutions corresponding to $\frac{1}{1000}$ gram. Five of the indoor samples and ten of the street samples showed over 100,000. The average for indoor dusts was 22,040 per gram and for street dusts 42,500 per gram. The ratio of acid-forming streptococci to total bacteria was 1 to 1157 for street dusts and 1 to 215 for indoor dusts, which is the general relation which might be expected if these organisms come mainly from the human mouth.

6. From the sanitary standpoint these results in regard to the streptococci are perhaps of some practical significance. The total numbers and the body temperature count, and even the determination of colon bacilli have no bearing on the transmission of disease if, as seems probable, the latter are mainly derived from the feces of the horse. If, however, the acid-forming streptococci are really of buccal orgin, our data indicate a somewhat surprising quantitative pollution. If a gram of house dust contains 20,000 normal mouth bacteria of this one type, and a gram of street dust contains 40,000, it would seem that infectious organisms from the same source might be present in appreciable numbers, although it is of course not justifiable to assume that other organisms are necessarily as resistant to drying as the streptococci we have found.

7. The experiments of many observers, reviewed in the earlier portion of this paper, indicate that the tubercle bacillus and certain strains of streptococci and diplococci (some of them resembling the pneumococcus) are much more resistant than other pathogenic bacteria and may survive when dried in dust for several weeks. It must be remembered however that the reduction of bacteria under unfavorable conditions is a gradual process, rapid at first and slower afterwards, so that there is a marked diminution in numbers long before the organisms entirely disappear.

8. Actual isolations of non-spore-forming disease bacteria from dust have been confined almost wholly to a few findings of B. diphtheriae, and many findings of the tubercle bacillus and of streptococci and diplococci more or less closely resembling the pneumococcus. Isolations of the tubercle bacilli are by far the most significant. They indicate that this organism may sometimes be found in 5–10% of samples of dust not specially exposed to tubercular infection, while in the neighborhood of

phthisical patients 25–50% of the tests may prove positive. The experiments of Prausnitz (1891), Verdozzi (1908) and Le Noir and Camus (1909) suggest that B. tuberculosis may be present in numbers ranging from 5 to 20 per gram of dust.

9. It should not be understood that these results lend any weight to the theory of what is ordinarily conceived as the aerial transmission of disease. The dust examined by us and by others was lying inert on floors and other surfaces and could only be distributed in the air by more or less violent agitation. Such distribution does not ordinarily occur. The experience of the operating room has made it quite clear than even the ordinary septic organisms in quiet indoor air are almost negligible, and the experience of modern contagious disease hospitals tends strongly in the same direction. When dust is violently stirred up by dry sweeping or beating carpets indoors or still more by a March wind in a poorly cared for street we have however another set of conditions. Under such circumstances we take considerable quantities of dust into the nose and throat. If the dust contains 40,000 mouth streptococci, as our results indicate that it may, and if tubercle bacilli are present as often as other workers have found to be the case, inhaling and ingesting large quantities of dust may have a real sanitary significance.

10. While suggesting that dust inhaled or ingested in considerable quantities may be a real factor in the spread of certain diseases, we do not in any way dissent from the conclusion now generally accepted by sanitarians that in comparison with more or less direct contact and food infection it is quantitatively a minor one.

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THE SUCCESSFUL EFFORTS OF A SMALL CITY TO SECURE A MILK SUPPLY FROM TUBERCULIN TESTED COWS

C. H. Wells,

Health Officer, Montclair, N. J.

The Board of Health of the town of Montclair, N. J., since its organization in 1894, has been noted for the vigilance with which it has supervised the production and the distribution of the milk supply. The dairies have been inspected, the cows have been examined by veterinarians, samples have been analyzed, poor supplies have been excluded from the town, dealers have been prosecuted for selling adulterated milk or milk from filthy sources, and all matters pertaining to the milk supply have been published.

In 1906 two or three cases of tuberculosis were detected by physical examination in each of two herds. It was believed that other cases of the disease might exist, and the milk dealers were notified that unless they consented to the application of the tuberculin test to these herds the milk would be excluded from the town. The tests showed over 50% of reactions. This was a revelation to the Board. During the previous eight years, at least, all herds which supplied Montclair with milk had been examined periodically by veterinarians and the diseased cows excluded. Moreover, the stabling conditions were so superior to the average dairy that it was not believed that the disease could make such headway. It was apparently the duty of the Board of Health, in view of its own experience, to require the tuberculin test of all cows from which milk was obtained for sale in Montclair, and the following ordinance was adopted in April, 1907:

Article 8, Section 5. Cows and Feed. (a) No milk shall be sold or offered for sale or distributed in the Town of Montclair except from cows in good health nor unless the cows from which it is obtained have, within one year, been examined by a veterinarian whose competency is vouched for by the State Veterinary Association of the State in which the herd is located, and a certificate signed by such veterinarian has been filed with the Board of Health stating the number of cows in each herd that are free from disease. The examination *shall include the tuberculin test* and charts showing the reaction of each individual cow shall be filed with this Board. All cows which react shall be removed from the premises at once if the sale of milk is to continue, and no cows shall be added to a herd until certificates of satisfactory tuberculin tests of said cows have been filed with this Board.

Section 8. Cream. No cream shall be sold, exposed for sale or delivered within the Town of Montclair unless it be produced and handled in accordance with the requirements hereinbefore set forth for the production and handling of milk.

By an amendment passed in April, 1908, pasteurization under conditions prescribed by the Board of Health was allowed as a substitute for the tuberculin test.

With the present-day knowledge of the relation between bovine and human tuberculosis any board of health that does not require the tuberculin test, or pasteurization of the milk as an alternative, must be considered negligent. Legal decisions upholding the legality of the requirement are now numerous. It should be borne in mind, however, that at the time of the adoption of the Montclair ordinance in 1907 the reports of the English and German Commissions on Tuberculosis had not been published, nor had Dr. Wm. H. Park and other investigators made their series of experiments that have proven conclusively that a large percentage of certain types of tuberculosis in the human being is of bovine origin.

Within a short time after the ordinance went into effect all of the dealers, with two exceptions, complied with its requirements. One of these dealers withdrew from the business rather than apply the test and the other dealer, a large company, was granted an extension of time in which to bring about the application of the test to the large number of herds from which its Montclair supply was obtained. It is interesting to note that of the New Jersey cows that had not been tested previously, 25% reacted. Many of the figures that are available on the subject of the prevalence of tuberculosis among dairy cows relate to suspected or picked herds, whereas the percentage of reactions above mentioned represents conditions of herds taken practically at random over a considerable area, with the exceptions that they had more than the average veterinary inspection, and that they have been stabled under good conditions.

In order to avoid any possibility of a milk shortage in the winter season, to give every opportunity to the company above referred to for improving its supply, and to give full notice to householders, the Board subsequently voted to permit the company to sell milk until May 15, 1908, even if the larger part of the supply was from untested cows, and under date of November 1, 1907, the Board distributed a circular to every house in the town, stating the time and cause of the postponement and recommending that until all the milk delivered in the town was from tuberculin-tested cows, families which included children under three years of age should take milk from some one of the dealers who had complied with the tuberculin test ordinance. The Board also recommended that such families as continued to take the milk from untested cows should either boil or pasteurize it.

Notwithstanding the publicity that had been given the entire matter through the press and by means of circulars, two of which were distributed during the controversy in addition to the annual report, in which the matter was set forth fully, only a comparatively small number of customers changed over to a milk supply that was recommended by the Board of

Health, and the majority of these that did change over went back to the dealer, whose product was not recommended by the Board, just as soon as the agitation was over. This fact is another proof that, regardless of how food products are labelled, the cheapest article is the one that will be purchased by a certain class and that boards of health must see that the cheapest article is safe for consumption.

A few days before the expiration of the time limit above mentioned the company obtained a writ of certiorari which prevented the Board of Health from enforcing the tuberculin-test requirement until the right to pass such an ordinance had been established by the State Supreme Court. After many delays, the first testimony in the case was taken in November, 1908. The usual legal postponements followed so that it was not until April 17, 1911, four years after the ordinance was adopted, that the case was argued before the State Supreme Court.

Notwithstanding that the ordinance was inoperative by virtue of the writ of certiorari, the company, in 1908, commenced an action in the Circuit Court of the United States to enjoin the Board of Health from enforcing the same ordinance. The Board of Health endeavored to have this suit dismissed upon the ground that an injunction was wholly unnecessary, as the company had already obtained a temporary stay that would fully protect it until the final decision in the other action. The Board was unsuccessful in its efforts to have the suit dismissed, but the case was not pushed and no testimony was taken.

The decision in the State Supreme Court case was handed down on June 6, 1911. Every point at issue was decided in favor of the Board. The company promptly filed an appeal in the Court of Errors and Appeals and the appeal was about to be argued in November, 1911, when the company signified its intention of complying with the ordinance and withdrew both the appeal and the action that had been begun in the Federal Court. The legal status of the tuberculin-test requirement therefore reverted back to the Supreme Court decision and the ordinance became effective.

Only three milk dealers in addition to the one that had taken the matter to the courts, took advantage of the restraining order and refused to have their herds tested. As soon as the ordinance was reinstated, however, they promptly complied with its provisions. The company that had carried on the litigation arranged for a dual milk supply. One portion of the supply is from tuberculin-tested cows and the remainder is pasteurized. Emphasis should be laid upon the fact that the milk that is pasteurized must be produced and handled in accordance with the regulations laid down for the milk from tested cows. The pasteurization is merely a substitute for the tuberculin test and is only allowed upon resolution of the Board of Health and under conditions prescribed by the Board. The

Board has a perfect legal right to withdraw at any time its resolution allowing the sale of pasteurized milk.

A most natural question arises as to what effect the enforcement of the tuberculin-test requirement has had upon the price of milk. The number of dealers who sold milk from tested cows previous to the enactment of the ordinance was too small for the range of price of these supplies to serve as a guide to the normal range of price during the period under consideration. It is a fact, however, that the price of all the supplies that were from untested cows at the time of the adoption of the ordinance advanced one cent when the ordinance was enforced, with the exception of the price of the supply that is pasteurized, which remained unchanged. Many factors enter into the cost of milk and it must not be assumed that the increase of one cent per quart is wholly due to the expenses attached to the test. It has been proven that farmers will make money by applying the test if they can receive one-half cent per quart increase in price.

The witnesses in the case included such eminent men as Drs. J. G. Adami, John F. Anderson, Lawrence F. Flick, Harry D. Gill, Alfred F. Hess, James Law, John R. Mohler, Wm. H. Park, Ernest C. Schroeder and Theobald Smith. The testimony made a volume of over 900 pages.

The following extracts from the New Jersey Supreme Court decision in the case are of sufficient importance to be given here in the hope that they may be of value either in strengthening the convictions of some health board that already has the matter under consideration or in spurring some health official to renewed activity along the lines suggested:

1. "Boards of Health are empowered by the Act of 1897 (P. L. 270), and by the Pure Food Law of 1907 (P. L. 485), taken in conjunction with the Act of 1887 (P. L. 80) to prohibit the sale of milk from diseased cows.

2. "Whether cows from which a municipality is supplied with milk are diseased, is a question that may, in the first instance be determined by the local board of health.

3. "In determining whether cows from which a municipality is supplied with milk are diseased, the method of diagnosis adopted by the local board of health should be one that is well recognized, thoroughly approved, and as reliable as any.

4. "A local board of health may prohibit the sale within the municipality of milk from cows which react to the 'tuberculin test.'

5. "The action of a local board in adopting measures for the protection of the public health will not be set aside by the court if the board has acted reasonably upon evidence that might satisfy a reasonable man.

6. "Regulations for the protection of the public health are within the police power of the state and are not an illegal interference with interstate commerce if they have a real substantial relation to the public object which government can accomplish, and are not arbitrary and unreasonable and beyond the necessities of the case.

7. "We find that the tuberculin test is the most reliable method of diagnosis of tuberculosis in cattle now known; that while it is not perfect the percentage of error is as small as in any method suggested, and that it is more accurate than the method by physical examination. We rest this conclusion not merely upon the testimony in the case but upon the fact that it has been approved by judicial decision in Minnesota, Louisiana, Wisconsin and Penn-

sylvania, and adopted by the most recent statute in Delaware, Indiana, Maryland, Michigan, Minnesota, New Mexico, North Dakota, Oregon, Pennsylvania, South Carolina, Tennessee, Washington and Wisconsin, and for some purposes by Maine, Massachusetts and Vermont. The 'tuberculin test' referred to in the act of South Dakota is probably the same. A similar act was passed by our own legislature in 1899 (P. L. 484). These statutes are legislative testimony of cumulative force to the value of the tuberculin test as a diagnostic agent. We think, therefore, that the board of health is justified in the position that cattle which react to the tuberculin test are diseased. That conclusion may occasionally be erroneous, but is as nearly accurate as is possible. The statute empowers the board of health to prohibit the sale of milk from such cattle.

8. "It seems to be established that there is very little chance of communication of bovine tuberculosis to human beings above the age of sixteen years, but that there is a very serious danger of communication through the medium of milk to human beings under sixteen years of age and especially to children under five years of age. It is conceded that there are such cases. The concession that bovine tuberculosis may be communicated to young children and that although it appears in them in the less common forms rather than in the form of pulmonary tuberculosis, suffices to justify action to guard the young against the contagion. It is for the board of health to decide how many lives must be endangered, and whether the lives of a few infants or children are worth the effort and financial loss.

9. "The evidence justified a finding that the subjection of the cows from which a supply of milk is derived to the tuberculin test is a reasonable method of determining not only whether they are diseased, but also whether their milk may carry the germs of tuberculosis.

10. "Surely, milk from cattle that react to a tuberculin test has been exposed to disease, and if the cattle themselves may be kept out of the state, it is fairly within the discretion confided with boards of health to exclude also milk, the produce of the cattle, which it is proved may at times convey the disease.

11. "We think the ordinance in question is valid, and that the writ of certiorari should be dismissed with costs."

THE USE OF FISH AS A SANITARY MEASURE TO ELIMINATE MOSQUITOES

MARION MCMILLAN, M.D.

Assistant Sanitary Superintendent, Department of Health, New York

During my administration as local sanitary officer in charge in the Province of Camaguey, in the island of Cuba, during the recent intervention by the United States Government on that Island, the question of the elimination of certain species of mosquitoes, presented itself to the sanitary officers in charge, as one of paramount importance. Previous to this intervention, the occurrence of appreciable numbers of cases of Yellow Fever on the Island, had already attracted the attention of the United States, in as much as these cases were increasing in number at different points in Cuba. Sanitary conditions, as left by the U. S. Government at the close of the military occupancy succeeding the Spanish-American war, had been digressed from and protection against Yellow Fever was required not only of the non-immune residents of the Island, but also of the armed forces of the United States which were ordered on duty at this point.

The problem was a difficult one. A small idea of the vast extent to which sanitary measures were required, may be formed when I say that the larger number of Cuban towns are supplied with water for public consumption, from cisterns, commonly known there as "aljibes," large earthern jars "tinajones," holding from 100 to 500 gallons, rain barrels, and other receptacles for catching and storing rain water.

Stegomyia fasciata, or Stegomyia calopus, the mosquito which transmits Yellow Fever, is essentially, as is commonly known, a house inhabiting mosquito, preferring rain water for its propagation. It lays its eggs in anything that holds water around a house, such as in cisterns, water jars, barrels and other deposits. have noted enormous numbers of larvae of this species, in tin cans, broken bottles, in trash heaps where water was lodged, and even in small crevices in low roofs and on the tops of brick walls, as well as in drinking troughs and receptacles for cattle and chickens. Not only does the Stegomyia fasciata deposit its eggs in the receptacles already mentioned, but also when no water is found, on the inside of rain pipes and on the mossy, damp sides of wells and other damp and protected spots. By the word "protected" in this instance, I mean protected from the rays of the sun, which in the tropics, would quickly kill dry eggs exposed to it. The heavy dews at night, always noted in these latitudes, is sufficient to moisten the egg, and preserve life until a shower falls. Larvae appeared in certain instances in the water of cisterns completely under

ground and covered mosquito-proof, (with the exception of the pipe from the roof rain leaders) within a few hours after a shower, and greatly puzzled me by their presence. Observation of a few days, however, showed that eggs were deposited previously to a rainfall in such positions that the rain washed them into the cisterns, where, by their natural buoyancy they floated on the surface as if deposited in the natural way by the female mosquito and hatched out in the customary manner. The great problem was how to exterminate the Stegomyia in these towns. In the particular town that I have reference to, there existed upwards of 25,000 different permanent water deposits and as many more temporary ones. The first measure resorted to for the extermination of the mosquito in this particular place, was the thorough cleaning of the town in a sanitary way. Gangs of men with rakes, shovels, and picks were detailed to cover the town by consecutive streets, and to enter the houses, and one by one, clean up the yards and remove the debris from the same, by wagons furnished for that purpose. All cans, broken bottles, etc., were completely eliminated, and the tenants or owners of the houses whose yards had been cleaned, were warned that should further collections of such a character be allowed to accumulate, a fine would be imposed upon them forthwith.

The great question of how to treat the deposits of water used for drinking purposes, was still unsolved. The use of crude petroleum was now resorted to. This immediately created such a furor and public protest, that the measure had to be abandoned; the public postively refusing to drink petrolized water.

The next measure taken was the covering of rain barrels, jars, etc., with tin covers, the cisterns being covered with mosquito proof-netting. But in effectiveness the measure was a failure; the public being unused to the installation of sanitary measures and the observation of sanitary law. A sanitary inspector often would find the good wife of the house going to the grocery store with the tin top of the water deposits, which made a most convenient and admirable receptacle to bring charcoal and vegetables to the house in, or, in other instances, the good man of the house was found feeding grain to his horse in the back yard in the top that should have been keeping Stegomyia out of his rain barrels.

The next measure tried was the application of spigots to the jars and barrels, and nailing the tops on the cisterns, and the application of pumps to the same, but without positive results. Carelessness on the part of the public still existed and the measure had to be abandoned. The Stegomyia propagated on in their merry way.

In looking over the situation and in the course of inspections, it occurred to me that in many instances I had noted that in wells and cisterns where by chance, or otherwise, there had been introduced small fish by the children of the house, or others, that no larvae were present. I looked into

this matter further and found confirmation of my surmise that the fish destroyed the larvae. On studying the fish, the class which I observed gave best results were what are known as "Guajacones" a kind of small fresh water minnow, indigenous to Cuba, of which there are three genera and five species. They commonly inhabit the lagoons, streams and ditches of the Island, and seem to have a somewhat purifying effect upon the water they inhabit, assimilating to a certain degree, organic substances. They devour voraciously the larvae of the mosquito wherever found, and will destroy eggs as well, before they have hatched into the second stage of the development of the mosquito. These species of "Guajacones" are viviparous; the young fish recently born move about swiftly and grow very rapidly. The male attains a size one-third less than that of the female when full grown.

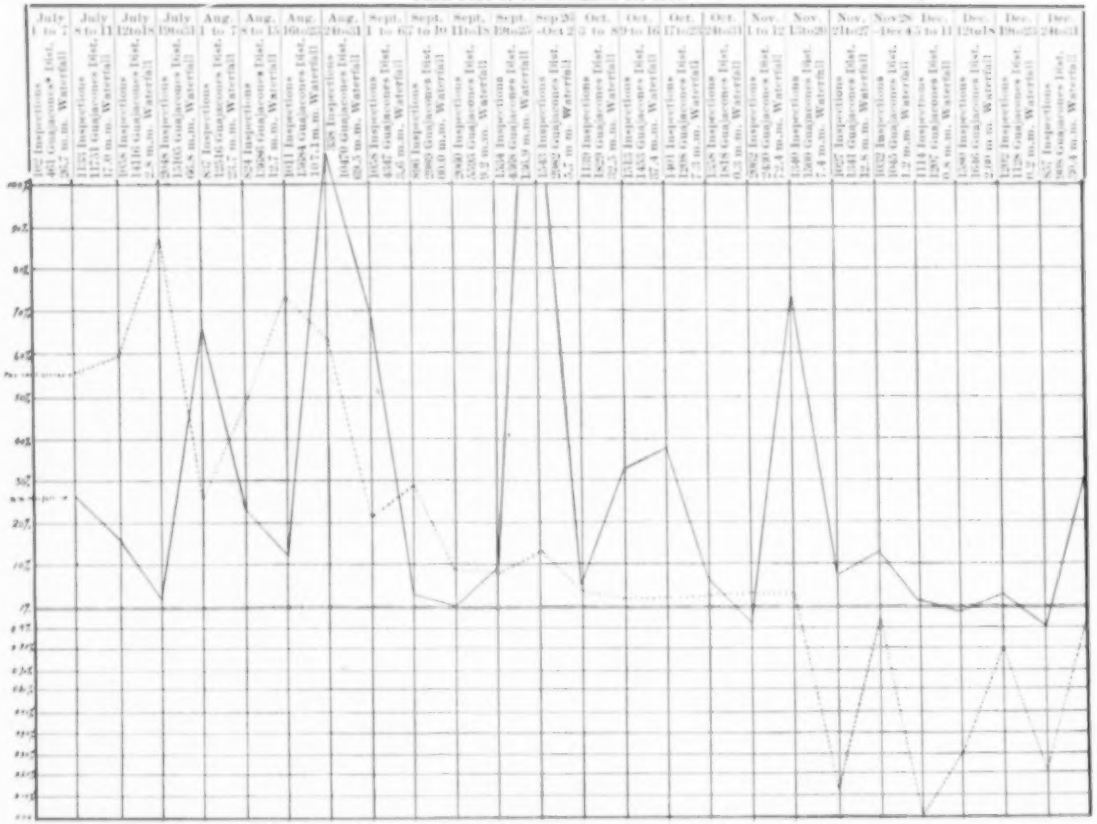
The female commonly destroys her own young by devouring them, so that the young fish must be kept by themselves as much as possible. The female gives birth about every thirty days, especially during the summer months. The first birth constitutes from ten to twenty little fish, according to her environment being favorable or not. The second birth usually approximates fifty. This occurs without any fecundation having taken place, repeated births occurring from time to time. Whether the females were born fecundated, I was unable to determine. The male fish can be easily distinguished from the female, as the latter have the anal fin much shorter, and the male has the anterior portion prolonged. The dorsal fin is distinctly constituted according to the genus; some presenting capsules, hooks, spines, fans, etc., marvels of construction not seen in any other genus of fish. (Poey).

The easiest genus to raise, on account of its being carniverous, is the "Gambusia Punctata," this is the hardiest species and is the most voracious in the destruction of the mosquito. The most beautiful is the "Guardinus Metallicus," which is a silver white. These fish live in schools, not only with those of the same species, but those of other species as well. In the town of Camaguey where I carried on these experiments, the following species were most common:

Gambusia Punctata
Gambusia Puncticulata
Guardinus Metallicus.

On the eighth day of July, 1908, after concluding that the only measure which would give positive results, would be the destruction of the larvae of the mosquito by the use of fish, I began to put in force the distribution of the above classes of fish throughout the town indicated. The first days were accompanied by difficulties, in as much as the collection of the fish from the rivers by men employed for that purpose by means of small nets, was accompanied by an excessive mortality amongst the fish. This

CHART SHOWING THE RESULT OF THE USE OF FISH FOR THE ELIMINATION OF THE MOSQUITO, EXPERIMENTS CARRIED ON AT CAMAGUEY, CUBA, FROM JULY 1, TO DECEMBER 31, 1908.


July 1 to 7
July 8 to 11
July 12 to 18
July 19 to 25
Aug. 1 to 7
Aug. 8 to 15
Aug. 16 to 22
Aug. 23 to 31
Sept. 1 to 6
Sept. 7 to 10
Sept. 11 to 18
Sept. 19 to 25
Sept. 26 to 30
Oct. 2 to 9
Oct. 9 to 16
Oct. 17 to 23
Oct. 24 to 31
Nov. 1 to 12
Nov. 13 to 20
Nov. 21 to 27
Nov. 28 to Dec. 4
Dec. 5 to 11
Dec. 12 to 18
Dec. 19 to 25
Dec. 26 to 31

The dotted curve indicates per cent. of water deposits in which larvæ was found in the number of inspections indicated at the top of the column. Absolute elimination of all larvæ was found to have been accomplished in the 1032 inspections between November 28th and December 4th.

The solid rainfall" indicates the total rainfall during the week ending as indicated at top of column. Note the corresponding rise in "Larvæ %" curve the second week following heavy rainfall.

m.m. = millimeters.

*The name of the class of fish used in this experiment.

mortality reached such an alarming point, that the feasibility of putting this measure into effect became questionable. I then determined to buy fish from small boys at 20¢ per 100, delivered to the Sanitary Department corral, in good condition and alive. This gave positive results as regards numbers, but the percentage of mortality still remained the same. I noted, however, that the fish caught late in the day died in large numbers, while those caught early in the morning usually lived. I, therefore, ordered the fish caught at daybreak, before the heat of the tropical sun manifested itself, and had them transferred to their destination before 6 a.m.

The work of distributing necessitated the use of comparatively small receptacles. In these deposits heavy mortality occurred due evidently to the change of water, and the rapid exhaustion of the oxygen from the same. The fish presented a condition of lethargy upon being introduced into these deposits containing rain water instead of river water, so I determined to employ a gradual attenuation method, changing the water gradually from river water into rain water before the final distribution of the fish took place, with the result that the mortality was greatly reduced, and the method of distributing the fish became feasible. The attenuation of the fish lasted practically from about four to seven days. Tanks for the reception or storing of the fish were prepared, and each inspector was provided with a bucket, preferably of wood, with a movable cover, and carrying approximately 200 fish. The fish are not transferred from the buckets to the final deposits by hand, (the hand should not touch the fish in this transference), but are caught in a ladle and finally introduced into the earthen jars or barrels to be treated. They should not be thrown into the water, but the ladle submerged below the surface and the fish allowed to swim away. The distribution took place before ten in the morning, and after four o'clock in the afternoon.

My observation as regards the destruction of mosquito larvae in deposits where these fish had been introduced, was that fish from one month old on, destroy the larvae when found by them, without regard as to the class of larvae. They will destroy the larvae of the "Culex Pipiens" or the "Anopheles," as well as that of the "Stegomyia."

I provided a 500 gallon deposit with six fish, and allowing the deposit to remain uncovered and open to the air, giving free access for mosquito propagation in it. The jar contained numerous larvae upon the introduction of the fish; but I could demonstrate no larvae after four days, and no further propagation occurred while the fish were present; the water in the jar remaining clear and palatable, and free from algae, as well as larvae. These fish will live on algae and infusoria when larvae are not present.

The accompanying chart will indicate exactly the reduction of mosquito propagation, as well as the total rainfall occurring from July 1, 1908 to Dec. 31, 1908 and the total number of fish employed to obtain these results:—

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THE PLAGUE SITUATION

If demonstration were wanting of the efficiency of modern sanitary methods no better example could be found than in the way in which plague has been controlled in Porto Rico and Cuba and its advancement upon American soil stayed.

From the beginning of the epidemic on June 17, 1912, to August 20, 1912, there occurred on the island of Porto Rico 49 cases of bubonic plague of which 23 died.

The Surgeon General of the U. S. Public Health Service was notified at the beginning of the epidemic, and it becoming apparent that the number of officers in Porto Rico was insufficient to cope with the situation Passed Asst. Surg. R. H. Creel, an officer having considerable training and experience in the eradication of bubonic plague, was ordered to San Juan on June 20. Pending his arrival P. A. Surg. S. B. Grubbs, U. S. P. H. S. the Chief Quarantine Officer of Porto Rico took charge of the situation in co-operation with the local authorities. From time to time other officers have been ordered to the assistance of Dr. Creel and the expenditure of $7000 per month from Federal funds has been allowed for the work of eradicating plague in Porto Rico. A laboratory for the examination of captured rodents was installed under the charge of P. A. Surg. C. W. Chapin, and several thousand rats are already being examined weekly from all parts of the island.

Upon the declaration of plague in San Juan, the usual panic supervened. A large number of persons left the city, and a spasm of cleanliness which resulted in the dumping of much garbage into the street followed. Eye witnesses state that the city underwent a cleansing such as it had not received in many years. The greater number of cases occurred in Puerte de Tierra.

To date 3 cases with 2 deaths have been reported from Havana, Cuba.

No infected rats have been found and apparently the infection was limited in its extent and was apprehended very early. However, the collection, examination and extermination of rodents is being continued in that port.

Another plague focus has been discovered in the United States by the finding of a plague rat in New Orleans, La., on July 27, 1912. Plague preventive measures had already been begun by Dr. Oscar Dowling, the state health officer and by Dr. W. T. O'Reilly, the city health officer, in conjunction with Surgeon J. H. White, U. S. Public Health Service. This work has been expanded and continued, and Passed Assistant Surgeon E. Francis and Passed Assistant Surgeon R. A. Herring, have been dispatched to Dr. White's assistance. No other plague infected animals have been found although several hundred rats have been examined.

Plague preventive measures have also been instituted in several of the other cities on the advice of Surgeon General Blue—Key West, Pensacola, Mobile, Norfolk, Philadelphia and New York, have all started to catch and examine rats.

Sanitary science and efficient application have served to ward off a scourge and to protect our public health and commercial interests. There has been a spirit of good team work on the part of the municipal, city and federal health authorities. Future campaigns will be won by a continuation of this efficiency and team work.

THOMAS BAILEY McCLINTIC

The recent death of Dr. Thomas Bailey McClintic, of the United States Public Health Service, from Rocky Mountain spotted fever which he contracted while supervising the work of eradication of this disease in Montana, adds one more name to the list of those who have given up their lives for the cause of humanity.

At the request of the Montana State Board of Health, Dr. McClintic had been making researches into this disease and was superintending the measures for its eradication especially in the Bitter Root Valley. His work had been crowned with such success that no cases had taken place in that section of the country during this season. While pursuing laboratory investigations with infected ticks, Dr. McClintic was bitten and developed the disease, which ran a rapid and fatal course. By the death of Dr. McClintic, the Public Health Service has met with the loss of an officer whose work held every promise for a brilliant and useful future, and a large circle of his friends will miss the presence of a singularly lovable character. Dr. McClintic will not, however, have died in vain as his death will emphasize, as would be possible in no other way, the necessity for the eradication of this disease, and his work will indicate means by which this can be successfully accomplished.

REVIEW OF LEGISLATION PROPOSED TO AND ENACTED BY THE GENERAL COURT OF 1912

MARK W. RICHARDSON, M. D.

Secretary of the Massachusetts State Board of Health

Read before the Massachusetts Association of Boards of Health, July 25, 1912.

The amount of legislation proposed to and enacted by the general court each year is enormous and grows in volume with each succeeding year. In this increased legislation public health questions have played no small part and any detailed treatment of health legislation for the year 1912 would consume much more time than is available this afternoon. I shall be compelled, therefore, to restrict myself to the merest outline in my treatment of the subject, in the expectation that the points of greatest interest to the association will be brought out in the discussion.

No year would be complete at the State House without a discussion of the vaccination question and 1912 has been no exception in this respect. There were the usual bills to abolish vaccination entirely and to admit children to the public schools without restriction. These were to be expected from experience in previous years. A new bill, however, devised by the anti-vaccinationists, and one quite clever in its conception, was House Bill No. 34 entitled "an act to provide for protecting the purity of vaccine virus." This bill provided, amongst other things, that the distribution, sale or offering for sale or having in possession with intent to distribute or sell, vaccine virus which contains staphylococci, streptococci, bacilli of tuberculosis, etc., be forbidden. Inasmuch, however, as it is impossible to produce vaccine virus which does not contain staphylococci of a non-virulent type, and inasmuch as a vaccine virus which is sterile is also worthless, it is easy to see what the effect would have been had this bill become law. As a matter of fact, all the vaccine bills were given leave to withdraw.

A subject of cognate interest is that of specific inoculation against typhoid fever and, as regards this procedure, the legislature by the enactment into law of a bill introduced by the State Board of Health gave that Board the power to produce and distribute not only antitoxin and smallpox vaccine, but also "specific material for protective inoculation against typhoid fever and such other diseases as said Board may, from time to time, deem it advisable to produce and distribute."

As regards the antityphoid vaccine, measures are now being undertaken for its production by the Board and it will be available to physicians and boards of health probably within the next month or six weeks.

House Bill No. 32 provided for a board of registration of masseurs and the defining of its powers and duties. This bill was given leave to withdraw, although there can be little doubt that the profession of massage is one which should be regulated much more closely than it is at the present time. The legislation of 1911, required that masseurs should be licensed by local boards of health and this necessity for licenses should have brought about a considerable improvement in conditions affecting this profession. The legislature of this year amended the law of last year so as to allow a person licensed to practice massage in one town to exercise the profession in another town without further license.

House Bill No. 323, placing the supervision of all buildings or parts of buildings which are occupied as biscuit, bread or cake bakeries or for the manufacture of flour or meal food products under the State Board of Health, was recommended favorably by the Committee on Public Health, but was rejected in its third stage by the House. As a further evidence of the tendency to regulate occupations of various types, House Bill No. 490, providing for legislation requiring the licensing of cooks and bakers was presented. This bill, however, did not get beyond the committee stage, in spite of the fact that conditions under which cooking and baking are done are without doubt susceptible of grave criticism.

The conditions under which our people live is a subject of the greatest importance and House Bill No. 541 providing for the appointment of a commission to investigate housing conditions within the Commonwealth would seem to have had good reason for existence. The matter was, however, referred by the Committee on Public Health to the next Genera Court.

Chapter 635, however, an act relative to tenement houses in towns would seem to be of great importance. It goes into great detail as to the condition under which tenement houses may be built and maintained, and provides, amongst other things, that no tenement house hereafter erected shall occupy, either alone or with other buildings, more than 65% of a corner lot nor more than 50% of any other lot; that each tenement shall have 25 feet of frontage on the street and that the total window area in each room, including water closet compartments and bathrooms, shall be at least one-seventh of the superficial area of the room, and the top of at least one window shall be not more than eight inches below the ceiling, and the upper half of it shall be made so as to open the full width; there shall be also at least one room containing not less than 150 square feet of floor area.

Each apartment must have a separate water closet located in a bathroom or separate compartment. No water closet shall be placed in the cellar, and there shall be no living rooms in the cellar.

Furthermore, the State Board of Health shall have power to examine into the enforcement of the laws relating to tenement houses in any town, and whenever required by the governor shall make an examination and shall report the result thereof to the governor within the time prescribed by him therefor.

House Bill No. 1047 finally enacted as Resolve No. 117 provides that the State Board of Health shall instruct and assist local boards of health as to the best method of extermination of mosquitoes and for this purpose an appropriation of $1,000 was voted.

In order to carry out this act the Board proposes to distribute free of charge to local boards of health and to any other citizens interested, Bulletin No. 88 of the Bureau of Entomology of the United States Department of Agriculture, concerning mosquito prevention. This pamphlet gives a quite complete discussion of the subject and will be available for distribution within the next few weeks.

Incidentally, I may add that practical demonstrations of the efficiency of marsh drainage are now available, in case any person desires to investigate, at Ipswich and also in the town of Revere.

Chapter 334 provides that in every city, except Boston, and every town which accepts the provisions of this section or has accepted the corresponding provisions of earlier laws may, for the prevention of fire and the preservation of life, health and morals, by ordinances or by-laws not inconsistent with law and applicable throughout the whole or any defined part of its territory, regulate the inspection, materials, construction, alteration, height, area, location and use of buildings and other structures within its limits, except such as are owned or occupied by the United States or by the Commonwealth and except bridges, quays and wharves, and may prescribe penalties not exceeding one hundred dollars for each violation of such ordinance or by-laws.

A bill affecting quite extensively certain activities of the State Board of Health was House Bill No. 385, establishing a department of labor. This bill was finally enacted as Chapter 726, Acts of 1912, and takes away in practically its entirety that portion of the work of the State Board of Health relating to factory inspection and occupational hygiene. To be sure the Board still has the power of investigation concerning occupational diseases in their relation to the public health, but executive functions are practically removed from the sphere of the Board's influence and deposited with a sub-division of this bureau of labor.

Entirely apart from the progressive character of the work done by the Board in this department, it would seem to be distinctly questionable

whether it will be found desirable to have removed this health work from the State Board of Health, especially as it involves the formation of a new health body and will, in that way, complicate the health administration in the Commonwealth. This act does not go into effect, to be sure, until June 1, 1913, and perhaps the legislature of 1913 will modify the provisions of the act. As it stands, at present, however, the State Board of Health will have no active part in the enforcement of health laws in factories and mercantile establishments after the 1st of June, 1913.

Chapter 470 of the Acts of 1912 empowers the Secretary of State to place upon the birth return blanks a synopsis of Chapter 251 of the Acts of 1905. The Secretary of the Commonwealth has accordingly placed the following words at the top of the birth return blank in red ink:

> Redness, swelling and unnatural discharge from one or both of the infant's eyes within two weeks after birth must be reported immediately to the Board of Health.

Chapter 280 requires a statement in the birth return as to "whether or not the physician or midwife signing the birth return personally has attended the birth." The Secretary of the Commonwealth has accordingly placed at the bottom of the state birth return blank the following words in red ink:

> State on this line whether you personally attended the birth:
> Yes or No.....

Section 17, Chapter 29 of the Revised Laws states that,

> City and town clerks shall distribute the blank forms as the Secretary shall direct. A city or town may provide such books and forms, if they conform to those prepared by the Secretary.

Local boards of health can help to lay a firm foundation in their infant hygiene work by making it clear to city and town clerks that their birth return blanks should be similar to those distributed by the Secretary of the Commonwealth.

The law concerning the reporting of ophthalmia neonatorum will then be under the eyes of the doctor every time he signs a birth return. Information will also be available as to what physicians are signing birth returns for midwives.

Chapter 280 of the Acts of 1912 requires that the full report of the birth must be made within two weeks, and that, if this full return is not made within 48 hours, at least, a brief notice of the birth must be mailed or delivered to the clerk or registrar of the city or town in which the birth occurred within 48 hours, stating the date and place of birth, giving the street number, if any, the number of the ward (in a city) and the family name.

Chapter 280 also requires that the city or town clerk or registrar shall file daily with the local board of health a list of all births reported to him. This notice should be insisted upon by local authorities. If received regularly within 48 hours, local boards of health will be in a position to inaugurate any necessary plans concerning infant hygiene.

Chapter 59, Acts of 1912, to restrict the use of common towels reads as follows:

"In order to prevent the spread of communicable diseases, the State Board of Health is hereby authorized to prohibit in hotels and in such public places, vehicles or buildings as it may designate the providing of a common towel, and the Board may establish rules and regulations for this purpose."

Then follows the penalty clause.

Regulations were made and published just before June 1, when the law went into effect, but they were modified at the last meeting of the Board to read as follows:

"It shall be unlawful to provide a common towel:

"(a) In any lavatory used in connection with a public institution, school-house, hotel, restaurant, theater, or public hall; or

"(b) In lavatory used in connection with a railroad station, railroad car, steam or ferry boat."

The term "common towel," as used in these regulations, shall be considered to mean a roller towel or a towel available for use by more than one person without being washed after such use.

Chapter 263, Acts of 1912, requires that insect powders containing compounds of fluorine must bear a poison label. This law was passed because in a number of instances insect powders known as roach salts had been sold as Rochelle salts and a number of cases of poisoning had resulted therefrom.

Legislation concerning drinking water on trains was enacted in Chapter 581. This act in effect requires that the individual drinking cups instead of reposing in the pockets of the trainmen must now be contained in receptacles close to the water tank. Individual cups, however, are not required in private cars, sleeping cars, dining cars or parlor cars.

The general power for the enforcement of this law is in the hands of the State Board of Health.

Chapter 486 of the Acts of 1912 requires that no stable may be located in any city or town having more than 5,000 inhabitants unless licensed by the municipal board of health. This law reads now as follows:—

"No person shall erect, occupy or use for a stable any building in a city or in a town having more than five thousand inhabitants unless such use is licensed by the municipal board of health, and, in such case, only to the extent so licensed. The provisions of this section shall not prevent any

such occupation and use which was authorized by law on the fourth day of May in the year eighteen hundred and ninety-five, to the extent and by the person so authorized, but the board of health of such a city or town may make such regulations or orders relative to the drainage, ventilation, size and character of stalls, bedding,"—these being additions, "size and character of stalls, bedding"—"number of animals and the storage and handling of manure in any stable in their respective cities or towns as in their judgment the public health requires."

By Chapter 652 of the Acts of 1912 the business of cold storage of certain food products was placed under the supervision of the State Board of Health. It is provided that cold storage establishments must be licensed by the State Board of Health and must make quarterly reports to it as to the amount and character of food products stored within their precincts.

No food product may be kept in cold storage more than 12 months and it must be marked with the date of entrance to the cold storage warehouse. In all places in which cold storage products are sold throughout the state must be posted a sign stating that "Cold storage products are sold here." Food products may be kept in cold storage longer than 12 months by special permission secured from the State Board of Health. The Board is allowed to make rules and regulations which must be carried out by the different establishments under penalty.

Chapter 489 prohibited untrue and misleading advertisements and it was hoped that, through this act, various patent medicines might be eliminated from the advertising pages of our newspapers, but careful reading shows that it is very doubtful whether this chapter will be of any special value in this respect. The law for instance states that individuals or corporations must "knowingly" make or disseminate untrue information, and the persons making accusations have to prove that it is untrue and calculated to mislead, so that the carrying out of this law or prosecution under the law will be very difficult indeed.

The law in relation to isolation hospital and hospitals for tuberculosis which was passed in 1911 was found to be defective in some respects and was modified in 1912 so as to be a practicable measure.

The requirements of different cities and towns vary tremendously and it was found very difficult to enact a law which would fit all situations. Under these circumstances the legislature saw fit to leave to the State Board of Health the decision as to what arrangements should be made in special local situations. There would seem to be no reason, therefore, why in the near future local needs should not be investigated and satisfied with a minimum amount of friction and expense. This law is as follows:

"Each city shall, and each town may, and upon the request of the State Board of Health, shall, establish and maintain constantly within its limits one or more hospitals for the

reception of persons having smallpox, diphtheria, scarlet fever, tuberculosis or other diseases dangerous to the public health as defined by the State Board of Health, unless there already exists in the city or town a hospital for the reception of persons ill with such diseases, which is satisfactory to the State Board of Health, or unless some arrangement which is satisfactory to the State Board of Health is made between neighboring cities or neighboring towns, or neighboring cities and towns, for the care of persons having such diseases. All such hospitals established and maintained by cities or towns shall be subject to the orders and regulations of the boards of health of the cities or towns in which they are respectively situated. Plans for the construction of the said hospitals shall be approved by the State Board of Health before the hospitals are constructed, and the state inspectors of health shall annually make such examination of said hospitals as in the opinion the the State Board of Health may be necessary. A city or town which upon the request of the State Board of Health refuses or neglects to establish and maintain such a hospital shall forfeit not more than five hundred dollars for each refusal or neglect:—provided, however, that if, in the opinion of the boards of health of two or more adjoining cities or towns, or a city and an adjoining town or towns, such hospitals can advantageously be established and maintained in common, the authorities of the said cities or towns may, subject to the approval of the State Board of Health, enter into such agreements as shall be deemed necessary for the establishment and maintenance of the same."

Chapter 637 modifies slightly the Act of 1911 as regards remuneration to cities and towns establishing tuberculosis hospitals, and is really complementary to the law just read.

Chapter 468 provides that citizens of the state shall be given preference in admission to the Rutland State Sanatorium, and that a person shall not be re-admitted who has not been a resident of the Commonwealth for six months.

House Bill 1248 provided that Section 39 of Chapter 75, which requires that "such isolation hospitals shall not be established within one hundred rods of an inhabited dwelling-house situated in an adjoining city or town, without the consent of such city or town," should be repealed. This bill, however, was given leave to withdraw.

Chapter 112 is a resolve that "the State Board of Health and the trustees of hospitals for consumptives, acting as a joint board, shall consider and report in print to the general court, not later than January first, nineteen hundred and thirteen, a definite policy for the treatment of tuberculosis in the Commonwealth with special reference to the unification of all health work under one central authority and the division of responsibility as between the Commonwealth and the community, giving due consideration to the relative needs of incipient and advanced cases of consumption and to the means now in use or authorized to meet the same, with any additional recommendations which may seem advisable."

Chapter 52 provides for a state exhibit to the Fifteenth International Congress in Hygiene and Demography. Invitations to take part in this congress were sent out some months ago by the State Committee to every city and town of the Commonwealth, and I understand that the members

of this Association have received a great deal of literature on this subject.

It is not necessary, therefore, to call to your attention that speakers from all over the world will be present and discuss all phases of the great subjects of hygiene and demography.

As you know, the powers of local boards of health to make regulations as to the conditions under which food may be sold was seriously questioned in Supreme Court decisions last year, more especially in relation to the so-called "dip tank" decision rendered against the board of health of the city of Boston.

This year a number of bills were introduced in the legislature to correct this situation, but most of them were given leave to withdraw. One, however, succeeded in running the gauntlet and was enacted into law as Chapter 448, which gives to local boards of health the power to make such regulations subject to the approval of the State Board of Health. There is, therefore, no reason now, apparently, why local boards of health should not be able to make properly stringent rules as to conditions under which food products may be sold in their respective localities.

That portion of the law which is new follows:

"Boards of health of cities and towns may make and enforce reasonable rules and regulations, subject to the approval of the State Board of Health, as to the conditions under which all articles of food may be kept for sale or exposed for sale, in order to prevent contamination thereof and injury to the public health. Before the board of health of any city or town submits such rules and regulations to the State Board of Health for approval it shall hold a public hearing thereon, of which notice shall be given by publication for two successive weeks, the first publication to be at least fourteen days prior to the date of the hearing, in a newspaper published in such city or town, or, if none is so published, in a newspaper published in the county in which such city or town is located. Any party affected by such rules and regulations, in the form in which they are presented to the State Board of Health for approval, may appeal to the said board for a further hearing, and said board shall not grant its approval to rules and regulations concerning which such an appeal has been taken until it has held a public hearing thereon, advertised in the manner specified above in this section with reference to hearings before boards of health in cities and towns."

An effort made by those interested in the improvement of the character of medical practitioners in the state by requiring that applicants for registration as physicians should be graduates of medical schools considered reputable by the State Board of Registration in Medicine was lost. (House Bills Nos. 845 and 846.) This movement was supported not only

by the so-called regular schools of medicine, but also by the homeopathic schools.

As usual a large number of bills were introduced for the control of the production, transportation and sale of milk. This legislation finally simmered down to a discussion between two bills—the so-called Meaney Bill as opposed to the so-called Ellis Bill. The Meaney Bill placed the power of making regulations in the hands of a paid board of six: three members to be chosen by the State Board of Health and three by the State Board of Agriculture: the administration of these rules to be under local boards of health. The so-called Ellis Bill was favored by the Milk Consumers' League and also by the Committee of the Massachusetts Medical Society. It placed the making of rules in the hands of an unpaid board of five: two to be learned in medicine and bacteriology; two milk producers; and one sanitarian. The carrying out of these rules, once made, was to be placed in the hands of a milk division to be established by the State Board of Health.

The Ellis bill was opposed strongly by representatives of the producers,—also by a considerable number of local boards of health and their milk departments. The opposition of the farmers is easy to understand, for they have always been consistently antagonistic to any inspection by the State Board of Health. The opposition of many local boards of health which have taken little or no interest in the subject is easy to understand. The opposition from more enlightened boards of health is, perhaps, not to be wondered at, inasmuch as the fear was present, and perhaps justified, that State-wide milk inspection might eliminate and render unnecessary successful milk departments already established. There can be no doubt, however, that in any system of milk inspection placed under the State Board of Health there would be no intention or desire to displace any efficient system of local administration.

Efforts to eliminate this ground for opposition by amendment of the Ellis Bill failed, apparently, to convince these more efficient boards of health as to its possible success in meeting the situation as outlined. At all events these bills having see-sawed back and forth in the House for a number of weeks were both finally killed, so that no milk legislation was passed, with the exception of Chapter 448 just mentioned.

House Bill 1251 represents the annual attempt of disappointed candidates for the practice of medicine to escape from the decision of the State Board of Registration in Medicine and provides for an appeal to a board of three physicians to be approved by a justice of the Superior Court. Each member of the board was to be paid not more than $10 daily. That sum was to come from the petitioner and the decision of the board as to the applicant's qualifications was to be final.

Needless to say the bill was given leave to withdraw.

House Bill No. 840 provided that power be given to the State Board of Health to draw up adequate regulations for the control of each disease declared by the State Board to be dangerous to the public health. These regulations were to be carried out by the local boards of health under penalty of not less than $500 for each refusal or neglect. This bill naturally met with great opposition from local authorities and although amended in various ways in an attempt to meet objections to it, it was finally rejected in the Senate.

Uniform practice as to the control of communicable disease is certainly much to be desired. Local boards of health often ask the State Board for information concerning length of quarantine, etc. Would it not be desirable to have a committee of this association draft a set of instructions on this subject so that methods may not vary so much in different cities and towns?

Another bill, the purpose of which was good, but which also failed to pass, was House Bill No. 1561 relative to washing the glasses, cups and other utensils in places where beverages are sold to be drunk on the premises. This bill required that such cups, glasses or other utensils should be washed in full view of the purchaser and by means of a separate cleanser before being again used. Any one who has watched the washing of glasses at a busy soda fountain can realize how much such a regulation as this is needed.

Efforts to escape from decisions of boards of health of cities and towns showed themselves in House Bills 843 and 1564. In the one instance appeal might be made from the local board of health to the county commissioners, board of aldermen or selectmen; in the other, an appeal might be made to the district police or the municipal court within the jurisdiction of which the property of the petitioner is located. Both of these bills, however, failed to receive favorable action.

House Bill No. 609 was introduced to amend the law relating to offensive trades and would have required every establishment in which the breaking out or canning of eggs is concerned to secure a license from the local health authorities in the same manner as slaughtering houses, canning, smoking or rendering establishments. This bill also provided for a more stringent inspection of meat, not only of that meat ordinarily sold, but also of flesh of any horse, ass or mule to be used for human food.

Only the food and drug department knows how great is the necessity for more stringent laws concerning these subjects. The business of dealing in eggs decomposed to varying extent is very large and can be kept under proper control only by very stringent supervision. There is no doubt, furthermore, that considerable horse meat is sold for beef. This bill, however excellent in many ways, was given leave to withdraw. A certain improvement in the situation, however, was secured by the enact-

ment of House Bill No. 222 requiring that all carcasses of neat cattle, sheep, swine, etc., sold in Massachusetts, must after the 1st of September, 1912, bear a brand stating that it has been inspected by a qualified inspector in such-and-such a town whether within or without the state. Up to this time carcasses slaughtered on farms outside of Massachusetts might be brought to the markets of the Commonwealth unstamped under certain federal exemptions. Furthermore, farmers in Massachusetts could slaughter animals less than six months old and sell them without inspection and without stamping. The new law which goes into effect September 1, as above stated, will require all carcasses to be stamped and this fact will render meat inspection much more simple and effective than it has been in the past.

The interest of the general public in venereal disease is increasing very rapidly as shown by House Bill No. 496, providing for the establishment of a commission to devise means for preventing the spread of the disease. Also House Bill No. 1254 providing for the education of the public concerning certain diseases through the issuing of a pamphlet explaining the nature and effects of venereal diseases by the State Board of Health.

Although action on these two bills was postponed, there can be no doubt that legislation on this subject is imminent.

The reporting of venereal disease has already been required in the state of California and also in the city of New York. To be sure the manner of reporting has been modified in that the name of the person affected need not be given, the case being reported simply by office number, but these enactments represent a distinct beginning along lines of prevention and the subject is one which will have to be grappled with in this state before very long.

The possible transfer of communicable disease through the agency of telephone transmitters has, of course, been apparent. House Bill 608 provides for weekly disinfection of all such transmitters.

The amount of labor involved in such disinfection is manifest and it is not surprising that the bill was given leave to withdraw.

After several failures, a bill to regulate the practice of optometry was finally passed by the Legislature and signed by the Governor.

This bill has been combated consistently by the medical profession for a number of years, but, as in a number of other states, the efforts of those who know most about the dangers of this legislation have proved fruitless. It is easy to foresee that many unfortunate individuals suffering from organic disease will be treated for a long time by optometrists with different brands of glasses before it is discovered that the basis of their troubles lies not in errors of refraction but diseases, perhaps, of the kidneys or brain.

That such a valid criticism should be of no value with legislators and governors is hard to believe.

Resolve No. 15 provides for an appropriation of $5,000 to be expended under the direction of the State Board of Health in its investigation of the disease known as anterior poliomyelitis or infantile paralysis. The Board has been investigating this disease, as you know, for five or six years. I am sorry to say, however, that in the last year there have been no discoveries of startling moment to announce.

MUNICIPAL HOSPITALS FOR CONTAGIOUS DISEASES

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Read before the Municipal Health Officers' Section, American Public Health Association, December, 1911, Havana, Cuba

There can be no doubt that the most important progress in medicine and in social economy during the last three decades has been in the prevention of disease. Not only have communities awakened to the fact that by applying the best principles of preventive medicine we can avoid the spread of disease and prevent its ravages, but that in so doing the people of the community are benefited in other material ways. And in no way is the saving of life and the improvement in the general welfare of the people at large better demonstrated than in the results achieved in the handling of contagious diseases in the municipality of to-day.

A most essential part of the equipment of a city in the battle against contagious diseases is an adequate hospital or series of hospitals for contagious diseases.

This is a statement which may be accepted as axiomatic,—yet how slow have the cities of all countries been to appreciate this fact. The first hospital for contagious diseases in general was opened in Glasglow in 1865 and in London in 1871, (Osler). The latter city has now nine hospitals for contagious diseases and one convalescent home—a very proper recognition of their importance.

Why is a municipal hospital for contagious diseases of such great importance? We may state that it is so for several reasons. The most important are:

1. The lack of adequate facilities for treatment of contagious diseases in many homes.
2. The difficulty of securing proper quarantine at home.
3. The nearer approach to absolute isolation in a properly conducted hospital.
4. The far smaller disturbance caused to business and social intercourse when a case of contagious disease is removed to the hospital.

1. The lack of adequate facilities for treatment in many homes cannot be questioned. In Philadelphia in 1910 of 1,925 cases of Scarlet Fever, 1219 were treated in the Hospital for Contagious Diseases. There is no

doubt that the great majority of the patients came from homes where the conditions as to general hygiene, food and medical attention must of necessity have been far less favorable to the patient's recovery than they were in the hospital. In 1910 in Philadelphia of 3,804 patients who had diphtheria, 2,235 were treated in the hospital and 1,569 at home. The mortality of the hospital cases was less than half of those treated outside. This does not in any way reflect upon the medical attendants in whose hands the home cases were. It merely demonstrates that in a hospital the conditions are far superior. The patients are under control—emergencies can be promptly met—facilities for the giving of antitoxin, for tracheotomy and intubation are at hand, and the physicians in charge know that proper food is being given these patients. It requires but a glance at some of the homes from which patients are brought to all Municipal Hospitals for Contagious Diseases to appreciate the fact that for a child to be stricken with a severe disease in one of them and be compelled to remain at home would be equivalent to sentencing it to death.

2. The difficulty of securing proper quarantine at home is a matter of great importance and while not entirely within the scope of our discussion upon the hospital itself, still furnishes one of the great reasons for the hospital's existence, and with the other factors mentioned will be discussed somewhat more in detail in another part of this paper.

Granted then, that a Municipal Hospital for Contagious Diseases is a necessity we may consider it from several standpoints. To me the important matters are

1. The relation of a Municipal Hospital to the Community.
2. The relation of the Municipal Hospital to the individual.
3. The ideal hospital for contagious diseases.

1. The relation of the Municipal Hospital to the community has already been alluded to in discussing the necessity for its existence, and while a great reason for this is the inability of any one properly to care for most of the patients in their home environment, yet the greatest need of the community for a hospital for contagious diseases lies in the fact that it provides isolation, and by isolation only can ideal protection to the public from infected individuals be obtained. Home quarantine must always be faulty because of several factors which depend so entirely upon human nature itself as to be practically ineradicable. First of all we have to deal with the ignorance of parents, friends and relatives concerning the gravity of infectious diseases and the mode of their spread. Then again much of the harm in the spreading of truly contagious diseases such as scarlet fever, measles and diphtheria may be attributed to pure carelessness on the part of those who at one time or another come into contact with the patient. But finally and most important of all we have to deal with,

the innate selfishness of most individuals and their indifference to the welfare or health of the people in general. It seems that people are prone to wilfully conceal the presence of contagious diseases in their homes and to do everything possible to withhold such information from the public. They seem to consider the action of the health authorities as an interference with their rights as citizens. In part this feeling may be due to the deep rooted fear of hospitals dating to a period when they really were places to be dreaded. Yet in part it is due to a certain perverseness, present in greater or lesser degree in all human beings which leads all persons to resent aid from all authorities as an unwarranted infringement on their rights. In short their whole attitude may be stated to show a lack of the altruistic spirit.

In communities in temperate climates such as we find in all the cities of the United States and practically all of those in Europe, the definite contagious diseases with which a municipality must deal in a hospital are Scarlet Fever, Diphtheria and Measles. The first two are eminently suitable for hospital care. Measles, a far more serious disease than is generally supposed might also well be treated thus, were it not for its wide prevalence in epidemics and a positive refusal on the part of both the medical profession and the laity to regard it as anything but one of the very minor ailments of childhood.

A hospital for contagious diseases in order to properly fulfill its function towards the community must be prepared to deal with these diseases efficiently and to prevent their spread throughout that community.

The accommodations therefore must be adequate. Abroad it has been found necessary to have 9–10 beds per 10,000 of population and this is probably a minimum, (Osler). Moreover it should not be thought necessary that cases should be sent into the hospital whether they are proper ones or not. It is a great mistake to allow the sending in of moribund cases, except under unusual circumstances, for they tax the capacity of the hospital without any adequate return to the community or to the individual. The admission of patients should be left entirely to properly trained physicians upon the ambulance of the hospital in conjunction with a corps of competent diagnosticians, whose duty it is to examine and diagnose the cases.

To crowd wards barely adequate with others in whom it is easy to see that no contagious element exists is wrong from every point of view. It not only hampers the work of the hospital but exposes previously non-infected patients to the danger of contagion. I consider that a large part of the success of the municipal institution in Boston has been due to this very discrimination in accepting cases. In the year ending January 31, 1910, of 3192 applicants for admission, 328 were rejected because of the absence of infectious disease. A hospital for contagious diseases has also a very

definite capacity for handling patients. When this is exceeded none of those under treatment can receive the proper care or attention. Better where there is room for 100 cases take 100 and care for all properly than to admit 125 and care for none to the very best advantage. Overcrowding in a general hospital is a serious menace to the welfare of the patients—in an institution for the care of contagious cases it makes good care impossible. Therefore it is evident that in an adequate hospital of this kind there must always be a considerable excess of room and facilities over that which is needed upon ordinary occasions, for there are sure to be periods of extraordinary prevalence of one or other of the diseases to be cared for, not to mention the ever-threatening danger of cross-infections. It is true that this tends to make such a hospital even more expensive than it always must be, yet to save money by limiting accommodations would be to save it at the expense of many lives.

It is not necessary that a hospital for contagious diseases should be in the outskirts of a community. There is a common impression that a central location of such a hospital would tend toward the dissemination of disease in its immediate environment, but this view has been abundantly disproven by experience. However in view of the need of much ground for the proper construction of such a hospital it will usually be found far more feasible to place it some distance away from the central districts of the city.

The points in which a hospital touches upon the interests and rights of the community at large are then very plain. Its advantages are manifest—if it be conducted in a manner which experience has shown to be the best.

But while primarily the hospital is for the protection of the community against the spread of contagious disease there are several important features in its relation to the patient.

2. The relation of a hospital for contagious diseases to the individual is in every way as worthy of consideration as its relation to the people in general. There are several duties which the hospital owes to its patients. Primarily they are:

1. The best of care and treatment for the disease from which the patient is suffering.

2. Protection from other diseases which are treated at the hospital.

3. Protection from other diseases which patients may bring into the institution.

Good care and treatment for any disease depend upon the possession of proper facilities and room for the accommodation and treatment of the patient. As has been stated this is true in the very largest degree of patients suffering from contagious diseases. In these, such are included as the proper handling of any and all complications which may arise during

the course of the disease and also the patient's discharge in a condition in which he is not a menace to others. I have already mentioned this point in a discussion of the relation of the hospital to the community and shall return to it when discussing the actual arrangement of the hospital.

2. When a patient is admitted suffering from a certain disease it is important that during his stay he should be protected from other diseases treated at the institution. We have no right to take a patient suffering from diphtheria for instance and expose him to infection with scarlet fever or vice versa. As McVail so forcibly puts it we must secure for the patient isolation and protect him from aggregation. In order to protect the patient to the utmost it is important that the promiscuous herding of patients even of those suffering from the same disease, should be avoided. It is of course impossible to achieve the ideal i. e. the isolation of individual patients. The cost of such a procedure puts it out of the question. We can, however, procure isolation to such an extent that our wards do not become hotbeds of infection of various kinds.

It is equally important to protect patients, suffering from any one disease, from diseases which other patients of the same group may be incubating. Thus a diphtheria patient on admission may be in the incubation period of scarlet fever or measles and the infectiousness of these diseases in their initial stages is well known. The arrangements to secure such isolation are various and will further on be discussed in greater detail. Particularly in addition to the contagious diseases we should observe in female children the presence of a vaginitis and if possible such cases also must be isolated.

Therefore, understanding that it is the duty of a municipal hospital to protect the community from patients suffering with contagious diseases while they are ill, to give the patients the best possible care, to protect the patients from double infections, and to send them home harmless, we are ready to consider in detail the ideal hospital for contagious diseases.

The ideal Municipal Hospital approaches as nearly as possible entire isolation of patients. Absolute isolation is impossible, but it is our duty to get as near to it as is possible. Isolation hospitals are more expensive than any other kind because the ratio of patients to attendants is of necessity small if the patients are to be properly cared for and protected one from the other. Therefore economy must be especially considered; not the economy which says "A penny saved is a penny made," but rather that which says "A penny judiciously spent is a penny earned." Isolation is preventive medicine in its fullest and most practical sense, therefore all expenditures, judiciously made, ultimately mean an enormous saving in life, health, and money to the community. In other words a dollar spent to-day in preventions means many dollars saved to-morrow in treating the actual disease.

Hospitals for contagious diseases above all things to accomplish the most

good for the money spent must be conducted to secure "isolation and to avoid aggregation." Ineffective isolation brings cross infections and the hospital becomes a distributing center for all the diseases in the hospital. Crowding therefore is a most dangerous and harmful policy. It is avoided by providing sufficient accommodation and by carefully choosing proper cases for admission.

A modern hospital must be upon a large plot of ground and must include beside administration buildings, a series of pavilions for each disease to be treated, with lots of air space between wards and open air corridors and walks connecting them.

The essential portions of a hospital for contagious diseases are an observation or reception pavilion, wards for acute cases, and wards for convalescent cases. Equally important are proper ambulance facilities, an adequate exit building and a combined laundry and disinfecting station.

The observation or reception pavilion should consist of a series of as many isolated rooms with individual bath and toilet arrangements as it is possible to secure. These rooms should be separated by open corridors running at right angles to each other to allow the free circulation of air. These rooms should be so constructed that glass enters largely into the formation of the walls. This serves several purposes, the chief of which is that it enables one attendant to care for and keep under observation several rooms at one time. Moreover by allowing the patients to see each other and still be unexposed, it does away with the loneliness and depression of complete isolation. For the ideal hospital such a building could be utilized by admitting each patient separately into what would be an individual ward and retaining him there until he had safely passed the incubation period of diseases other than that for which admitted. Such an arrangement is hardly practicable because of the forbidding expense. Therefore such a building will find its use limited to the isolation and observation of cases of doubtful diagnosis, for cases with known contagious disease but previously exposed to others, and for the treatment of a limited number of crossed infections, thus doing away with the expense of operating a regular emergency ward.

A further important use to which such a pavilion may be put is in the aborting of outbreaks of cross-infections. Thus it is our experience that a case of measles or chicken-pox developing in the scarlet fever or diphtheria ward, though recognized at the earliest possible moment will infect some, but not all of the susceptible individuals exposed. Unless active measures be taken all susceptibles will ultimately become infected. Obviously the procedure is to isolate all susceptibles one from the other with the certainty that the crop, following the original infecting case will be the total extent of the outbreak.

In the observation building should be situated the receiving rooms, two in number, one to be in readiness always for emergency.

Acute wards should be so constructed as to limit the number of patients in each to not more than six. This serves to reduce to a minimum the dangers and disasters of cross infections.

Convalescent wards, to which patients should be admitted not before they have safely passed the incubation period of other infections, may be larger, holding as high as twenty beds.

Each ward should be equipped with a complete discharge or exit bath consisting of three separate parts—one in which the patient is divested of his clothing, a middle one in which he gets his final bath, and a third or perfectly clean part in which he is dressed in clean clothing handed in from the outside. This I consider a much better arrangement than making this a part of the general exit building inasmuch as it does away with the final mingling of many individuals from different wards and so further tends to promote isolation.

Ideal ambulance service means a clean ambulance, clean blankets, clean bedding, and one patient at a time.

A combined laundry and sterilizing plant should consist of three compartments, a middle one into which all unclean articles are placed, thence to be inserted into sterilizers and boilers built into the walls and opening after the process of cleansing is completed, into the clean rooms on either side.

Suitable and separate dormitories should be provided for the doctors, nurses and attendants. For their accommodation a general exit building on the same three-room principle as the smaller ones mentioned for discharge in connection with the wards, is essential.

The feeding of all can be looked after from a general kitchen, separate dining rooms being provided for doctors, nurses and male and female attendants. By means of food trucks all departments and wards of the hospital may be given safe and perfect service from this same kitchen.

In summing up we may state that the contagious hospital which most nearly fulfills its perfect function is that which attains to its fullest possible extent perfect isolation.

MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH

The quarterly meeting of the Massachusetts Association of Boards of Health was held at Gallup's Island, Boston Harbor, Thursday, July 25

The members were conveyed to the island on the city steamer "George A. Hibbard" and the quarantine boat "Relief" from Long Wharf at 12.30 P. M. On arriving at the island an inspection of the quarantine station was made and a shore dinner was served.

After dinner the president, Dr. Henry P. Walcott, chairman of the State Board of Health, introduced the business of the afternoon.

On motion, the reading of the records of the April meeting was dispensed with.

New members were elected as follows:

Dr. W. J. McDermott, of the Salem Board of Health.
Harvey B. Pitcher, of the Leominster Board of Health.
Albert K. Mann, of the Chelsea Board of Health.
Dr. J. P. Bradford, of the Acushnet Board of Health.
Dr. Royal Hatch, of the Wellesley Board of Health.

The PRESIDENT. Is there a committee prepared to report?

Report of the Committee on Milk Legislation.

Mr. Bolling, for the Committee on Milk Legislation, presented the following report:

The Committee on Milk Legislation desire to report that practically all the proposed milk legislation failed of passage at the last session of the Legislature. The bills relating to milk that survived were two in number: one that provided for a change in the labelling of containers of condensed milk; the other providing for an inspection of milk testing utensils by the Massachusetts Agricultural College.

GEO. E. BOLLING,
Chairman.

The PRESIDENT. If there is no objection, the report will be received and placed on file.

Is there any other committee prepared to report? If not, the principal business of the afternoon is a paper prepared by Dr. Mark W. Richardson, Secretary of the State Board of Health, Review of Important Bills Relative to the Public Health Considered by the Legislature of 1912. It seemed to your committee in preparing for this afternoon that it was

extremely desirable that the members of this Association should be precisely informed as to the course of legislation. It is so difficult to pick it out of the Blue Book that Dr. Richardson has prepared a very careful abstract of the various acts that relate to the public health, and you, gentlemen, must appreciate the fact that no one of these acts is of any value unless you are prepared to support it. The power of the Commonwealth in health matters resides in the body of medical men who represent the boards of health of the Commonwealth. Dr. Richardson.

Dr. Richardson's paper will be found elsewhere in this issue.

The PRESIDENT. It must be quite evident, gentlemen, that our legislators have done the best they could to earn their salaries as far as sanitary matters go. It is difficult to pick out any portion of Dr. Richardson's statement which is a subject for general debate or question, but he will be quite glad, of course, to answer any questions, and any suggestion that may come from any member here with regard to a subject for debate will be very cheerfully entertained by the Chair.

The meeting then adjourned.

HEALTH DEPARTMENT REPORTS

Erie, Pa.

The report for 1911 gives a very good account of the severe typhoid fever epidemic which occurred during the year. Erie has had to be enrolled amongst the list of American cities which have persisted in drinking a polluted water supply until retribution came, in this instance in the form of 1,067 cases of typhoid fever with 135 deaths. Pollution of the city's water took place through the discharge of the city's own sewage. The water intake is located at a point 17,361 feet from the city, 5,000 feet north of Presque Isle, which forms the outer boundary of Erie Harbor. Pollution of the water supply apparently only takes place when there is present a lake current from east and west, around the Isle, accompanied by a rapid lowering of level in the harbor. These conditions are produced by winds from various directions, but particularly when there are continued winds from the southwest.

It is interesting to note that, prior to the typhoid fever epidemic, there was a marked outbreak of acute enteritis. This occurred in December, 1910, and increased so rapidly that fully one-third of the population of the city was affected before the month ended. The health authorities considered this epidemic due to water pollution. The health department persistently called the attention of the public to the water as a probable source of the existing conditions, but "many thousands remained unconvinced, however, and professed to believe the disease was not typhoid, or if so, that it was due, not to water, but to some subtle miasmatic influence conjured up by the persistent rainy weather which had continued throughout the months of December and January; others, overlooking its widespread existence throughout the city, believed the outbreak to have its source in the milk supply, others in ice, in southern vegetables, in imported fruits, notably bananas, even garbage piles beyond the city limits were looked upon as factors contributing largely to the general ill. Spring waters, of which large quantities were consumed in certain parts of the city, also came in for their share of blame. It was observed by your Board, however, that the malady fell most heavily upon the working classes, among whom, the use of ice in winter, imported vegetables, high priced fruits, spring waters, etc., were looked upon as being unneeded luxuries, and, not having been used by its victims, could not be the cause of the trouble. Milk, too, could be excluded, a rigid comparison of the records of the County Medical Inspector for the State Department of Health and the list of dairies supplying the city, showing that typhoid had not been existent on any of the farms from which these products were obtained.

"Conditions continued to grow worse with great rapidity and the outbreak of winter cholera, noted in December, again made its appearance in a more severe form, adding many thousands to its list of victims; a conservative estimate of cases of this condition, made after a careful canvass of the city, showing that nearly or quite one-half of our total population suffered from it."

Steps were taken to treat the water with copper sulphate, and eventually with hypochlorite. The epidemic immediately commenced to subside. The health department arranged without delay for proper hospital facilities for the sufferers. It would be a good thing if this report could be put in the hands of the officials of those cities who still refuse to take steps to supply a safe water to their citizens.

Dr. John W. Wright, the Health Officer, reports the death rate to have been in 1911, 16.17.

In the division of the report devoted to food supplies, the names of all vendors of milk are given, accompanied by a list of the producers who supply them, together with the score and sanitary rating of the farms.

Similar information is given with regard to ice cream manufacturers. The publishing of these facts should undoubtedly have a good effect on the producers, and stimulate them to improve.

A very careful sanitary survey of the city was made, and resulted in a very general cleaning up. Dr. Wright points out that this clean-up resulted in a marked decrease in the fly nuisance.

Colorado Springs, Colo.

"The most important question which now confronts this department as well as the citizens of our city, from a sanitary point of view, is one which we have long appreciated as being a very vital one and which the public at large is coming more and more to realize as such, viz.: the prevention of tuberculosis."

This is one of the opening statements in the report of Dr. Omer R. Gillett, the Health Officer of Colorado Springs. It is followed by a very sane and logical discussion with regard to the desirability of properly informing the citizens of the extent of this disease. Dr. Gillett indicates that instead of being a disadvantage to the city in having its tuberculosis figures published, it is an advantage, as the Health Department can show a proper realization of the dangers, besides informing the public of the precautions which are being taken to prevent infection.

The death rate for 1911 was 15.03. If corrected for the deaths of tubercular cases, contracted elsewhere, it was 9.78.

The milk sold in Colorado Springs is from tuberculin-tested cows, and all cream that comes to the city to be made into butter is pasteurized before being sent to the churn. There was a marked decrease in the number of cases of contagious disease reported during the year. The necessity for medical school inspection is well emphasized and the recommendation of previous years for the establishment of a contagious disease hospital under the management of the Health Department, is repeated. The report does not contain any financial statement.

As customary this report is well printed and contains some beautiful illustrations of the scenery in this Pike's Peak region.

Asheville, N. C.

"Asheville opens wide her doors to the sick and the well from every clime, but she demands that the sick shall so comport themselves that they shall not become a menace to the health of her citizens or the stranger within her gates.

"It is in health that cities grow; in sunshine that their monuments are builded. It is in disease that they are wrecked; in pestilence that effort ceases and hope dies.

"Therefore, in the not very long ago, you created a Department. You bade it guard the public health. You gave it a trust that may not be broken. You charged it with a vigil that is sacred.

"And you assumed a duty. You tendered fealty to this your greatest department; for had you not bade it watch over the lives of men and women and little children?"

The above is reprinted from the cover of the July, 1912, Bulletin of the Asheville Health Department, which contains the annual Report of the Board of Health.

A number of new things have been inaugurated during the year ending May 31, 1912. One of the most important has been the establishment of a laboratory which has, amongst other things, made it possible to cut down the period of quarantine for diphtheria. Prior to the establishment of this laboratory, all cases of this disease had to be quarantined 28 days; the average length of time with laboratory facilities for making bacteriological examinations has been, during the past six months fourteen and one half days.

A rule has recently been established requiring the weekly disinfection by the Health Department of all moving picture halls. It is also required that the floors and seats of the same shall be wiped daily with a cresol solution.

A systematic inspection of hotels, restaurants, bakeries, candy kitchens, etc., on a scoring system has been installed and has produced great improvements.

The milk supply is of unusually high grade. It comes from tuberculin-tested cows and chemically and bacteriologically has been demonstrated to be excellent.

365 deaths were recorded which gives a death rate of 18.2. However 139 of these deaths were of people who came to Asheville from other States for the benefit of their health. Subtracting these the corrected death rate was 11.3.

In conclusion the health officer emphasizes under the title of "Things needed," the desirability of an incinerator plant, medical inspection of schools, comfort stations, and a new market house.

The report throughout is written in plain, forceful language, and is a good example of how to present the health status of a community in a public document so that it will actually be read and appreciated by the average citizen. Dr. McBrayer is to be congratulated on his report.

Nashville, Tenn.

The estimated population of Nashville in 1911 was 113,122, of which 75,677 were white. The total death rate was 20.19. The death rate for the whites was 15.72 and for the colored 29.24. Dr. W. E. Hibbett, the Health Officer states that during the year, the force of the Department has been increased by the addition of a nurse for Infant Mortality work. The work accomplished by this nurse has been so satisfactory, that the City Council has authorized the Health Department to increase the number of nurses to two or more.

Three hundred and seventy-one cases of typhoid fever with 59 deaths were reported. Of this number 73 were imported cases. With regard to the method of infection, Dr. Hibbett makes the following statements.

"We have had no cases during the year that could be traced to any definite source. In the opinion of the Department, when we consider the excellent quality of the city water supply, which is demonstrated both by bacteriological and chemical weekly analyses, there is no connection between the number of cases and the municipal water supply. The only criticism that we have to offer as to our municipal water is that quite a percentage of our population is forced to use water from other sources which are known to be contaminated, as in every instance where a case of typhoid is reported a careful examination of the drinking water is made and the preponderance of these tests demonstrate that, to say the least, these waters are very suspicious. But until the city is in position to supply such places with city water, the Board of Health is powerless to prevent the use of these waters."

The Health Officer announces the passage of an ordinance, providing for the establishment and maintenance of a Bureau for the Study and Prevention of Tuberculosis The Bureau, besides having an important educational function, is also to have a strict surveillance of all discoverable cases. Free clinics are to be established and home treatment is to be provided for those who are unable to visit the dispensaries.

Lowell, Mass.

The death rate of Lowell, Mass. for 1911 was 18.11, the lowest recorded since 1904, and the second lowest since 1890.

A special investigation was made by the Board during the year, with regard to the infant mortality. Twenty-five per cent. of the total deaths at all ages, were of infants one year or under. The evidence indicates that one of the chief causes for infant deaths was lack of breast feeding. The report states that it may be safely said that 68% of the babies are fed on mother's milk, which the Board of Health consider to be a remarkably good record for this large mill town.

PUBLIC HEALTH NOTES

A New Treatment for Pellagra.

"Dr. Jean Nicolaidi, of Paris, has devised an original method of treatment of pellagra, and a paper on the subject, which he read at the recent International Congress of Dermatology at Rome, is interesting. Dr. Nicolaidi holds that the main changes in pellagra are due to serious interference with nutrition. In order to overcome this nutritional disturbance it occurred to him that a serum might be employed in treatment, and he prepared a serum, which he calls an 'organopolymineralised serum'; its composition is not stated very definitely, but it is said to contain substances extracted *in vacuo* from horse serum, and organic and mineral substances from blood plasma, and it is also made radio-active. The first attempts to treat pellagra with this serum were made in Roumania in 1909, and the results are said to have been so good that he was asked by the Roumanian Government to employ the serum in the following year, and we are told that many patients suffering from the disease were rapidly cured or at least much benefited, and in some cases patients with severe mental symptoms who were in the asylum at Craiova were able to leave the asylum after 20 to 30 injections. During the summer of 1911 Professor Antonini was asked by the Health Department of Italy to arrange for a series of trials of the serum. These trials were made. Patients were taken who had severe symptoms and who had not shown any improvement under any other form of treatment. After about 25 injections all the symptoms had diminished in severity or disappeared, the general nutrition had much improved, and many patients were able to resume their occupations. The improvement in the skin lesions were as marked as the improvement in the symptoms; a change for the better was visible after five or six injections, and after 12 injections every trace of the scales and erythema had disappeared. As to the question of recurrence, only 2 cases out of 50 in Roumania showed signs of any return of the disease, and only 1 case of relapse occurred amongst those treated in Italy in 1911, and this in spite of the fact that the patients had not changed their diet. The results seem to be very encouraging, but it is probable that some of the constituents of this very complex serum take no share in the result."

The Lancet, Vol. I, No. XXIV.

How Fresh Fish get to Eastern Markets.

The ordinary person who calls up by phone, or even goes to the fish shops in Boston or New York, does not always know just where his fresh halibut or cod comes from; but if he lives farther inland he may fairly be in much greater doubt.

In a recent number of *Ice and Refrigeration*, a full description is given however of where an unusual amount of this fish comes from.

For the last twenty years the Puget Sound cities have taken advantage of the marvellous richness of the sea fauna of that Northern Pacific coast; but till comparatively recent years most of the energy and capital have been devoted to the salmon canning industry. Today this is markedly changing, for while it is true that the canning industry has extended from Ketchikan in Alaska, there has been a growing fleet of vessels engaging especially in halibut fishing on the outside of Vancouver Island and the Straits between that and Queen Charlotte Islands. Most of this trade has been done through Seattle; but the past year has seen two million-dollar plants erected in Canada, one at Vancouver, essentially an American Company operating from a Canadian base and sending their supplies to Chicago, Boston, New York and etc., but fishing in Canadian waters, and the other established at Prince Rupert, Lat. 55° the new city at the western terminus of the Grand Trunk Pacific R. R. almost completed from Halifax on the Atlantic.

The fish companies at Vancouver have steamers which start out with ice in their

bunkers, manufactured at the large plant situated on the docks, and which is used to chill the fish while the cargo is being made up. A catch of 300,000 pounds of fish may come in on a single steamer which is rapidly landed on the nearest ground floor cleaning room, when they are rapidly cleaned and beheaded, (this refuse going to make fertilizer). Thence the fish are sent into the freezing rooms which are long rooms with eight rows of pipes as shelves on either side of the passage, through which a double expansion ammonia ice plant sends the gas at temperatures 2–10°,6–15°F. Within 18 to 36 hours the whole cargo is frozen.

From this room the fish are passed into the "glazing" room, where they are dipped twice into vats of pure cold water. The excessive cold in the frozen fish causes an immediate ice coating on the whole fish, and in this condition the fish are wrapped separately in parchment paper and then packed in boxes lined with paper and sent by elevator to the cold storage ware rooms on the 2d and 3rd floors. Here they are kept at +10°, +15° F. until shipped East by rail. They are placed in refrigerator cars which are carefully constructed iron frames with insulating excelsior in the walls. At the two ends of the cars are ice bunkers filled up to the top, and the best cars have false floors and ceilings through which the cold air moves up through the cargo of fish boxes Refilling with ice *en route* eastward may be necessary; but fish so frozen may be kept and are kept up to an average of four or more months in the same state of freshness they had when placed first in cold storage. If such are *de-frozen* gradually through a series of increasing temperatures to 60°F. they will appear fresh and wholesome in the dealer's shops where they should be placed under a glass case for sale.

The precooling and cold storage from keel to the consumer is now the slogan of the fresh fish trade; and, as compared with old fashioned methods for supplying fish even in the local markets, has marked the application of pure science to the problem of supplying this important article of food to populations lying hundreds and thousands of miles from the source of supply. *P. H. B.*

6

Hookworm from the Orient.

Passed Assistant Surgeon Glover of the Public Health Marine Hospital Service at Angel Island, California, reports the results of a considerable number of examinations of Oriental immigrants for hookworm and other parasites. This work is undertaken as a part of the physical examination to determine whether or not the immigrants may be admitted to the country, and consists of microscopical examination and a sample of feces. Chinese, Japanese, and Hindus examined in this manner demonstrated a very considerable percentage of infection: Chinese females showing the smallest percentage, 20, and Hindu males the largest, 63. There is evidence that Japan, or at least certain distticts of it, is heavily infected with hookworm.

Doctor Glover points out the very real danger which the immigration of Orientals may furnish, not only from hookworm but from other tropical diseases, such as Amebiasis and malaria.

Journal of the American Medical Association, Vol. 58, No. 24.

"Shuttle-Kissing."

"An interesting report to the Home Office and to the Local Government Board, upon an inquiry into the alleged danger of the transmission of certain diseases from person to person in weaving sheds by means of 'Shuttle-Kissing,' has been issued as a Parliamentary paper. The matter affects workers in the cotton and linen industries, and evidence was taken in a number of towns in Lancashire, and in Glasgow, Belfast, and the north of Ireland. No evidence was found to support the allegations that in certain particular instances transmission of disease took place by 'shuttle-kissing.' The committee engaged in this inquiry report: 'Indeed, we might safely go a step further and say that we have not found evidence in any instance which would justify suspicion that the shuttles had been the means of transmitting infection.' They add that they are in hearty concurrence with the view that the practice is objectionable, and that it is desirable that some other method

of shuttle-threading should be adopted, but this opinion they hold, apart from the medical or public health aspect of the question, on the ground simply of decency and cleanliness of habit. As far as cotton is concerned, the committee hold that practical alternatives to the present form of shuttle should be found and the 'shuttle-kissing' is no longer a necessity. As regards flax, they were forced to the conclusion that the hand-threading shuttles, in their present form, may not be suitable for flax, and there was considerable doubt whether the mechanical suckers would pull the stiff fibre through the eye, but they found, on the other hand, when they visited Belfast, that in some sheds slight alterations were being made in the design of the shuttles to enable the weaver to push the thread through the eye with finger and thumb. The committee think that threading with the mouth (the weaver in the act puts the side of the shuttle to his mouth and uses an inspiratory suction to draw the thread through the eye, hence the term 'kissing the shuttle'), might be generally avoided by adopting such measures, or by the use of hooks of various forms, similar to a crochet-hook, which can be inserted through the eye, and will draw back the weft. While in agreement that the present method of threading is uncleanly and may even be a possible means of spreading infection, the committee do not think the time is yet ripe for insisting, either by regulations or by Act of Parliament, on the abolition of the existing form of shuttle. They feel that the facts elicited do not justify drastic legal action at present. The report is signed by Mr. Gerald Bellhouse (one of the superintending inspectors of factories), Dr. W. W. Fletcher (medical inspector of the Local Government Board), and by Mr. D. J. Shackleton (late senior labour adviser, Home Office). Dr. H. T. Bulstrode, one of the original members of this departmental committee, died before the inquiry terminated."

The Lancet, Vol. 1, No. XXIV.

Mississippi Floods and Typhoid.

An example of the extreme seriousness of flood conditions along the Mississippi River from the sanitary standpoint is offered by the recent experience of Memphis, Tennessee. In this spring's disasterous flood the river rose over the levees at the northern part of the city, the polluted water backing in and covering an artesian well district from which one-third of the city's water supply was obtained. After the river reached a certain stage the water obtained from these wells became turbid and gave analytical evidence of pollution. Cases of typhoid fever appeared and the health authorities called in George W. Fuller, of New York to take charge of the situation.

The polluted water was restricted to the commercial district, warnings were issued, and pure water was brought into this district. When the river receded, an examinatioa indicated that the infection had entered through cracks in the brick wall protecting one of the artesian wells. The polluted supply was then disinfected with hypochlorite of lime and all suspected mains were thoroughly flushed out. To prevent a repetition of this disaster, resulting in some 500 cases of typhoid and 30 deaths, it is proposed to raise the height of the levees to a thoroughly safe level. The experience in Memphis is significant of the sanitary dangers attending flood conditions in general, and should be a warning and example for health authorities in districts where similar conditions are likely to occur.

Eng. News. June 13, 1912. Vol. 67, No. 24.

The Milk Supply of New York City.

The bacteriological and sanitary condition of New York's milk supply has recently undergone investigation by M. C. Schroeder of that city's health department. A large number of bacteriological analyses of samples of milk were made at various points between production and consumption. Studies were also made of the age of milk delivered in the city, as well as of methods of cooling, temperatures at different points, and the efficiency of pasteurization. Comparisons are offered of the bacterial contents of raw milk sold in cans as compared with that in bottles, and this work has been duplicated for heated milk. Some of the forms used in keeping track of the work are reproduced.

Dr. Schroeder finds that whereas, "The greater portion of the milk is delivered by the dairymen to the creameries with low bacterial content, namely, less than 50,000 bacteria per c. c.," that the greater portion of milk sold in New York City as raw milk, whether in cans or bottles, contains from 50,000 to 1,000,000 bacteria per c. c. and a considerable percentage contains over 1,000,000 bacteria per c. c." The temperature of the milk delivered to the creameries in the summer months is too high, and the icing which the milk receives is insufficient.

Sterilization of cans and bottles is recommended. "A greater part of the milk sold is from 36 to 48 hours old, but a considerable portion is from 72 to 96 hours old, and some even more than 96 hours."

Journal of Infectious Diseases XI–1, July, 1912.

The Cultivation of the Leprosy Bacillus.

Three organisms to which etiological significance has been ascribed have, in the main, been isolated from human leprosy. The first of these is a non acid-fast diphtheroid bacillus first described by Kedrowski, and according to him, endowed with marked powers of pleomorphism; the second is an acid-fast chromogenic bacillus first described by Clegg, difficultly cultivated in the early stages but after a few transfers growing luxuriously as a saprophite and with characteristic yellow pigment; the third is a permanently acid-fast bacillus (Duval), resembling more closely the original bacillus of Hansen and very difficultly cultivated Doctors C. V. Duval and C. Wellman of Tulane University made a critical study of these organisms with a view to discovering which is the true B. Leprae.

In the course of their experiments they have been unable to discover any evidence of pleomorphism as between these three organisms. The chromogenic bacillus, although isolated from a large percentage of their cases, they now conclude, has probably little claim to being the cause of the disease. The acid-fast bacillus of Duval, on the other hand, is more probably the true B. Leprae, although the present authors do not believe they have as yet definitely established this. A pleomorphic diphtheroid bacillus corresponding to Kedrowski's was isolated from one of their cases, but they do not ascribe to it much importance, nor to the entire question of pleomorphism. The present paper contains not only the reports of their new original work but also useful historical and critical information.

Journal of Infectious Diseases XI–1, July, 1912.

Cavities in Teeth as Disease Carriers.

"At the beginning of an investigation to determine the best ways of terminating an epidemic of scarlet fever that had infested our city for three years, school inspection was instituted.

After the medical inspection was begun it took just sixteen days to free the public schools of the disease. Then our attention was directed toward a medical examination of the third grade and a dental examination of the third and fifth grades. Our fair city then had seven dentists, one of whom, James R. Pagin, D. D. S., was secretary of the board of education. Because of this position Dr. Pagin thought best not to do any of the examining, and we had six rooms to examine and six dentists to do the work.

190 children were examined.

937 cavities were found.

454 cavities were in permanent teeth.

77.9 per cent. of the pupils examined had cavities in permanent teeth.

50 had had scarlet fever during the present epidemic and two hundred thirty-eight cavities were found in their teeth.

2 of these had no cavities.

1 had 12 cavities.

2 had 10 cavities.

From this time on we looked to the condition of the teeth as well as the condition of the tonsils and nose, and insisted on all cavities being filled at once upon release from quarantine. I believe these cavities to be fine incubators for all pathogenic bacteria and cavities are known to contain the germs of diphtheria, pneumonia, tuberculosis, influenza and other known infections which enter the body through the respiratory tract, therefore, inasmuch as scarlet fever, measles, whooping cough, and mumps are

believed to be respiratory infections it is fair to presume that the cavities would be equally efficient incubators for these and other diseases.

In the near future I predict a dentist will be on the board of health staff and the teeth of all patients will be filled or the cavities sterilized before release from quarantine.

The work done last year in the schools was done with no expense to the board of education except blanks, and was so satisfactory that it is being continued this year and a reasonable compensation is to be paid." —Otis B. Nesbit, M.D., President Valparaiso, Ind., Board of Health.

Bulletin, Indiana State Board of Health, May 1912.

Enteritis and Typhoid at Rockford, Illinois.

In January and February, 1912, the city of Rockford underwent a very severe epidemic of a diarrheal disease, some 10,000 persons of a population of 45,000, and a smaller epidemic of typhoid fever of about 200 cases. Professor Edwin O. Jordan of Chicago University investigated the outbreak and showed that it was due to the pollution of a pure artesian water by contaminated ground water, which surrounded permeable basins. The water was drawn down in these basins or wells to a unusually low level on account of an unusual demand upon the fire service. Under these conditions the polluted ground water gained entrance and the epidemic resulted.

This is another case in which laboratory analysis has failed to indicate the danger which exists only under unusual conditions which emphasizes the importance of sanitary inspection, or in the words of Professor Jordan;—"In conclusion it may be said that while there is perhaps nothing remarkably novel in the cause and general character of the Rockford epidemic, the necessity of examining all the features of a water supply is further emphasized by this occurence. Analysis alone, not controlled or supplemented by inspection, may give no useful information, or may even mislead."

The engineering aspects of the question are dealt with by Professor Jordan in a short article in the Engineering News, Vol. 67, No. 24. The epidemic is more fully described by the same author and E. E. Irons in the Journal of Infectious Diseases, Vol. 11, No. 1, July, 1912.

Studies on Endo's Medium.

The chemical changes underlying the color reaction of this medium have been made the subject of investigation by E. R. Harding and Z. Ostenberg of Stanford University. The original explanation given by Endo of the color production by B. coli was that the fuchsin was reduced by the sodium sulfite, a colorless compound being formed, which again became red under the influence of acid produced by the organism. The present investigators have identified the colorless rosanilin salt with the well known "Shiff's aldehyde regent," and seem to have shown that the restoration of color is due not to the production of acid but of aldehyde. Endo's original explanation, and the one currently accepted, is thus overthrown.

Following up this discovery Harding and Ostenberg have experimented with the medium substituting other carbohydrates for lactose. Their results here confirm their earlier conclusion as to the responsibility of the aldehyde. Using xylose and arabinose the investigators believe they have arrived at a definite and useful means of subdividing the paratyphoid group.

Journal of Infectious Diseases, XI-1, July, 1912.

Dr. H. W. Hill.

Dr. H. W. Hill has recently severed his connection with the Minnesota State Board of Health and become Director of the New Institute of Public Health at London, Ontario. This institution is maintained in connection with the Western University, and Dr. Hill will be in charge of the post-graduate course leading to D. P. H. degree. He will also have charge of the general publicity work throughout the province concerning public health matters and will work in connection with the Ontario Provincial Board of Health.

Dr. Hill terminates a period of sixteen years' public health service in the United States, which began with the Louisville, Ky., Water Filtration Works in 1896. Dr. Hill's

many friends in this country will wish him every possible success in his new position.

Dr. W. P. Gerhard.

Dr. Wm. Paul Gerhard, the well-known Consulting Sanitary Expert, is leaving shortly for Europe, to attend the International Conference on Public and School Baths at Scheveningen, Holland, as the official delegate representing the United States. He will also attend the "City Planning Exhibit," at Düsseldorf, Germany.

Dr. Gerhard has recently donated a library of 265 volumes to the Sanitary and Biological Department of the College of the City of New York where the collection will be known as the "Dr. Gerhard Library of Sanitary Science."

Industrial Anthrax.

The June number of the *Journal of Hygiene* contains an interesting and useful article on the "Detection of Anthrax Spores in Industrial Material." The authors are Dr. E. E. Glynn, of the University of Liverpool, and F. C. Lewis. This is pointing to the fact that anthrax is still fairly common in Great Britain, there being 79 human cases with 12 deaths in 1910 (Great Britain and Ireland), and the best methods of detecting infection in different kinds of industrial material are discussed.

Their summary and conclusions are as follows:

"(1) There are two methods of examining industrial material for anthrax spores, viz., agar plate cultures and the inoculation of guinea-pigs.

"(2) Though no worker has yet made a large series of examinations of equal portions of the same material by both methods simultaneously, yet the available evidence indicates that animal inoculation is superior, provided that guinea-pigs, not mice, are employed.

"(3) It is better to inoculate two guinea-pigs than one, and to use the centrifuged deposit of the watery extract, though this practice may also increase the mortality from pathogenic anaerobes.

"(4) The inoculation of guinea-pigs is more successful than plate cultures mainly on account of the larger quantity of watery extract usually tested, which more than counterbalances the disadvantage that some of the animals died from anaerobes before they develop anthrax.

"(5) If plate cultures are employed it is essential to examine the superficial colonies after a short incubation, probably 12 to 16 hours is the most suitable.

"(6) Anthrax spores have been demonstrated by the inoculation method in 21.3% of 141 samples of industrial material, supposed to have produced anthrax in Liverpool amongst those who handled them. Of these samples 28.6% were from hides, 22.2% from wool, 20.6% from hair and 7.1% from bones. The largest proportion of infected samples came from Singapore.

"(7) Anthrax spores have been demonstrated in one sample of hair 'disinfected' with 5% fluid of high coefficient at 100 degrees C., and in two out of six samples of hair disinfected in Germany probably by steam at 105 degrees C. It is practically impossible to completely sterilize certain industrial materials without seriously damaging them; yet partial disinfection should on no account be abandoned, because the perfect method has not yet been discovered.

"(8) Anthrax appears to be steadily increasing among domestic animals, and consequently a larger number of agriculturists are becoming infected. The reason for this dissemination amongst animals is still obscure.

"(9) We have found *B. anthracis* in sample of pea meal used for feeding cattle confined to a shippon, one of which died of anthrax. The meal was probably infected from the sack.

"(10) Anthrax is preventable among men and domestic animals, and its ultimate suppression depends largely upon the certainty with which bacteriologists can demonstrate the presence of absence of bacilli in suspected industrial food, or other materials."

Removal of the Tonsils.

"In the Maryland *Medical Journal* for June, Dr. John N. Mackenzie, professor of laryngology and rhinology in the Johns

Hopkins University, inveighs against the indiscriminate removal of the tonsils, which he attributes not only to mistaken views of the American profession, but to insistent demands of the laity. He points out that the functions of the tonsils are at present unknown. Whether they are portals of entrance or exit for infection, whether they protect the organism from disease or invite its entrance, whether the pathogenic bacteria sometimes found in them are coming out or going in, whether they are manufacturers or storehouses of leucocytes, and whether their destruction means the removal of a battle-line against the passage of infection from the throat to the neck cannot be stated. Until these questions are settled the final word on the removal of the tonsils cannot be said. Whatever its functions, the tonsil is not, as is generally believed, a lymphatic gland. Its physiological integrity is important in childhood. It appears in the fourth month of embryonic life, attains maturity at the end of the first year of infancy, and about puberty tends to diminish its size. It does not develop as a lymphatic gland from a plexus of pre-existing lymph vessels in the mesothelium, but as an ingrowth of endothelium from the second branchial pouch, and therefore resembles the thymus and thyroid, which originate respectively from the third and fourth branchial pouches. All these bodies are produced by inbudding of the endothelial lining of the primitive pharynx. In a recent careful study in comparative anatomy, Gordon Wilson, of Chicago, has shown that the tonsil secretes or excretes into the pharynx. The role of the tonsils as portals of infection Professor Mackenzie considers greatly exaggerated. He admits that they are so in certain cases, but to a less extent than the more abundant and receptive lymphatic structures of the nose and naso-pharynx. The tonsils are frequently held responsible for the results of morbid conditions situated elsewhere. If obstruction to respiration due to adenoids be removed, the tonsils will often take care of themselves. Even if they remain large and are causing no trouble they may be safely left, and as growth of the child proceeds they will become less conspicuous. The mere size of the tonsil Professor Mackenzie considers no indication for removal. A large tonsil does not necessarily mean a diseased one, nor does a small one mean a healthy one. That the tonsil has some important function is shown by its frequent growth after enucleation. Another point is that the tonsils play an important part in the mechanism of speech and song. They influence the action of the surrounding muscles and modify the resonance of the mouth. On the other hand, they may be so enlarged as to cripple both these functions, and then should certainly be removed. The changes in anatomical relations produced by tonsillectomy cannot be foretold, no matter how skilfully the operation is performed. The adhesions and contractions which sometimes follow, even in the best of hands, often ruin the singing voice. Professor Mackenzie shows that he would long hesitate before advising the operation in a great singer, or one depending on the voice for a livelihood. He considers that tonsillectomy is a dangerous operation which should be done only in a hospital or other place where there is every facility to meet the gravest emergency. It should be done only by a surgeon skilled in its performance, thoroughly equipped for every accident, and fully alive to the fatalities which have sometimes followed. He does not decry the many excellent measures which modern ingenuity has devised for operation on the tonsil when there are definite reasons for their application."

Annotation, *The Lancet*, June 29, 1912.

After the Summer Vacation.

"It has been found at Liverpool that many cases of infectious disease amongst school children, which would, during school terms be notified, are not notified during the vacations, and children who are still infectious or who may have been in contact with infection, may, therefore, return to school whilst convalescent. To obviate these occurrences, Dr. E. W. Hope has advised that on the reassembling of the scholars after vacations, the head teachers of the infants' departments should be instructed to enquire of the children if any of them have been ill

during their vacations, and refer all possibly infectious cases to the medical officer of health, whose staff will make the necessary home inquiries."

The Medical Officer, July 6, 1912.

Rats and Plague.

The quarterly bulletin of the Louisiana State Board of Health is devoted entirely to the rat and its relation to the public health. This subject is, of course, of special interest in Louisiana at the present time. The following from a recent issue of the *Daily Picayune* is also of interest in this connection.

"Officials of all railroads coming into New Orleans will meet with the local health officers in the office of the State Board of Health in the New Orleans Court Building tomorrow at 10 o'clock to discuss the advisability of rat-proofing all freight cars used to transport freight to and from the city. It is well known that freight cars are carriers of rats and plague infection can be spread from town to town by this means. In all cars an inside wall extends half the way to the top. The top of the wall is not sealed, allowing rats a hiding place between the inside and outside walls. The health authorities want the top of the former covered."

Ventilation of School Rooms.

The recent report of a special committee of the New York City Board of Education on ventilation of school rooms contains many important recommendations of interest, among them the following:

1. That the temperature of class rooms in school buildings shall range between 60 and 68 degrees Fahrenheit, and of halls and passageways between 60 and 65 degrees Fahrenheit, unless the outdoor temperature be higher.

That a large size tested thermometer showing temperatures between about 50 and 100 degrees Fahrenheit, be hung from the ceiling in front of the teacher's desk in each class room.

That the thermostats be set at 65 degrees Fahrenheit.

2. That the windows in all rooms be opened for three minutes after each class period, the children meanwhile doing physical exercise, and between 12 o'clock noon and 1 o'clock as part of the school routine.

3. That wherever there are transoms over windows or doors or other openings into the halls from class rooms they be kept open, at least in part, the whole time.

4. That in new buildings, windows be made in small sections, with pivots and adjusters.

That in schools which are provided with artificial systems of ventilation the systems be operated only when inclement weather forbids adequate window opening.

That a concisely worded card of instructions be mounted in each class room.

That the principals of evening schools be permitted to order the operation of the ventilating systems.

That the amount of heating surface in the halls and class rooms be reduced.

That three visiting engineers, to assist in the operation of heating and ventilating plants, be appointed.

5. That every possible encouragement and facility be given by the Board of Education for the establishment of open-air classes.

That every practicable facility be offered to any responsible committee which wishes to take observations in the schools as to ventilating and heating conditions.

Sewage Farms and Typhoid.

"A serious epidemic of typhoid fever is reported from Retford. Dr. A. E. Manners Smith, M. O. H., has had the assistance of Dr. Henry Handford, C. M. O., in investigating the causes of the attack, which is believed to be connected with the milk derived from cows grazed at the borough sewage farm. How the milk became contaminated has not yet been ascertained. Over thirty cases have been notified, and the small-pox hospital is being used for the reception of patients."

The Medical Officer, July 27, 1912.

An Important Fly Bulletin.

One of the most important fly bulletins yet issued is that which has recently come from the office of the State Board of Maine.

In the introduction it is pointed out that lots of people come every year to take a look at the beauty of the natural scenery of Maine. "Most of the visitors are pleased, but, now and then, some of them, unfortunate in the choice of a place or hostess, says 'flies'." The following three reasons are given why the fly nuisance should be done away with:

1. It is a rational protection against the spread of infectious diseases.

2. It will preserve us from the misfortune of losing our self-respect and the respect of others.

3. Neatness and cleanliness are a good bit of financial investment; they tend to fatten the wallet, particularly if we are catering to the wishes of our modern and better sort of people for food, refreshments or air.

Individual Drinking-Cups.

"Most teachers who have tried the plan of having individual cups in the school where the attendance is large, have found themselves involved in a number of difficulties. Some of these difficulties have been overcome in the adoption of the following plan, which for over a year has been in practice in one of the largest primary schools of the state.

"On the first day of school the teachers asked each child to bring on the following day a square of colored cotton cloth of such a pattern, or so marked, as to be easily recognized. The last half hour of the second day's session was used to make these squares of cotton into bags. The teacher explained to the pupil that these bags were for drinking-cups and asked each child to bring a small agate or tin cup which was to be kept in the bag. This bag was to be hung on the pupil's hook in the cloak-room or on the framework of the desk in rooms when the pupils did not pass through the cloak-room in going for a drink. In either case, the cup is always ready for use, being protected by the bag from the germs and dust of the school-room, and at the same time much less in the way of the pupil than when on or in the desk. The cup is less likely to be lost when in the bag and as the bags are easily distinguished there are seldom disputes as to the ownership of the cup.

"Nails or hooks are provided in the yard where the bags may be hung during recess.

"On Fridays the pupils are asked to take the cups home with them and see that they are carefully washed and scalded, and occasionally the bags also are washed. The plan thus affords an opportunity for training in sanitation as well as a practical method for getting, and, what is far more difficult, keeping individual cups."

Miss N. C. Stevens in *Florida Health Notes.*

Remuneration for Board of Health.

"I know of no person or persons connected with the city administration who work without any remuneration whatever, except the members of the Board of Health. While they do not have as many meetings as the Board of Aldermen, I am quite sure their work is of equal importance with the Board of Aldermen. And I think the city of Asheville has accepted this work as a gratuity long enough. Occasionally a member of the Board of Health is called upon to go out and inspect certain conditions in order that he may act intelligently upon the same.

"We recommend that the Board of Aldermen pass a resolution or ordinance paying the members of the Board of Health four dollars for each meeting attended, whether it be Board of Health or the Joint Health Board: those members of the Joint Health Board who are *ex-officio* members of the Board of Health to receive no extra compensation when they attend meetings of the Joint Health Board."

Dr. McBrayer in *Bull. of Health Dept.*, Asheville, N. C., July, 1912.

Insects.

The February, 1912, Bulletin of the Pennsylvania State Department of Health is devoted to those insects which have been shown to transmit disease. The general biological facts concerning these insects and, in each instance, the remedies to be used to eradicate the pests are briefly indicated. Attention is paid to mosquitoes, flies, fleas, cockroaches, bedbugs, house ants, the various kinds of lice and the itch mite.

An Epidemic of Trachoma at Hudson.

"The Training School for Girls at Hudson is suffering from an epidemic of trachoma The disease was probably introduced into the institution last March by a girl from New York, who had been treated for this trouble for a year past and who evidently was not cured when admitted. Since March one hundred and twenty cases have been reported to the State Department of Health. A special investigation of the epidemic was recently made by Dr. H. D. Schenck, consulting ophthalmologist to the department, and the eyes of eighty children were examined, all of whom, with the exception of three doubtful cases, showed evidence of the disease. About one third of the population of the institution have become infected through neglect of quarantine measures. Special instructions as to quarantine and treatment were given to the house physicians and officers which, if carried out faithfully, will free the institution from the disease, although it will be several months before the eyes are all well.

Monthly Bull. N. Y. State Dept. of Health, July, 1912.

Infant Mortality in Canada.

"The most complete report we have yet seen relating to the problem of infant mortality in Canada is from the pen of Dr. Helen MacMurchy dealing with the Province of Ontario. It is disquieting to find that she has first of all to admit that the laws with regard to the registration of births are so inadequately carried out that but little reliance can be placed upon statistics relating to birth-rates and, therefore, also to infant mortality. No one, she says, seems to know much about the registration of births in Ontario. The law actually requires, under a maximum penalty of two pounds, that a birth shall be notified to the district registrar within 30 days of its occurrence by the father or mother of the child, or by the occupier of the house in which the child is born, or by the nurse present at the birth. If a doctor is in attendance he must notify the birth to the registrar forthwith. By comparing the list of baptisms with the list of children registered in a given area within a stated period it was found by Mr. R. E. Mills, B. A., that only about 75 per cent. of the total number of births came to be registered, a circumstance which is much to be deplored. Still worse, out of 636 births registered in Toronto, as many as twenty were registered twice. The reasons given for this neglect are the lack of training of the inhabitants in the necessity for registration, and the fact that the registrar receives only 20 cents for each registration. Prosecutions for non-registration appear to be quite unknown. Better registration might be secured if prosecutions were undertaken, or if doctors were paid a fee for notifying the fact of a birth having taken place. Subject to the qualifications referred to, the infant mortality rate in 1907 was 120 per 1,000 births in Ontario, and 148 per 1,000 in Toronto.

"Dr. MacMurchy deals at some length with the causes of infant mortality and makes some valuable suggestions for reducing it. These include the prompt notification of a birth for which the first person to do so should receive a fee of one shilling, the Registrar-General supplying doctors with stamped addressed post cards for use in notifying; a grant from the Provincial Government towards the salaries of doctors and nurses employed in infant welfare work in any municipality; a grant from the same source for an infant nursed by the mother in any Provincial institution, hospitals, infants' home, etc., and a smaller grant if the child is not nursed, and the establishment of a bureau of infant care and management or infant welfare under the control of the Secretary of the Provincial Board of Health. It is further suggested that every certificate of death relating to a child under twelve months old should state the exact method employed in the feeding of the child."

The Medical Officer, July 27, 1912.

Hookworm Disease in North Carolina.

Dr. W. S. Rankin, in his annual report, makes some interesting remarks under the title of "The Effect of Hookworm Disease Exaggerated." He points out that of 6,858

death certificates filed during 1911, only two certificates assigned hookworm disease as the cause of death, and on only one certificate was this disease noted as a contributory factor. He concludes this portion of his report as follows:

"Until this time the public mind has rated hookworm disease altogether on the *frequency* of infection and utterly ignored the equally important factor, the *severity* of the infection. In order to appreciate the importance of this disease from a public standpoint, it is not only necessary to know that 800,000 North Carolinians carry the parasites in their intestines, but it is equally necessary to have some reasonable idea, based upon an ample investigation, as to the number of worms the average host contains. We must recognize the principle that parasitism is one thing; pathogenesis another thing. Has the average North Carolinian, has the average Southerner, ten, thirty, fifty, one hundred, or two hundred hookworms? For thirty-five college students from which the worms were carefully counted by the Allen J. Smith method, there was an average of but twenty worms. A letter from Dr. Bailey K. Ashford of Porto Rico, in answer to an inquiry from me, states that he regards from three hundred to five hundred worms necessary to produce recognizable symptoms; that it would require from seven hundred to fifteen hundred to produce medium or rather severe infection, and from two thousand to three thousand to produce death.

Reasoning from the facts in the case, the vital statistics from this State, a very large part of the 30 per cent infection of our people is so light as to be, *comparatively* speaking, a case of parasitism more than a condition of pathogenesis; and hookworm disease ranks, in North Carolina, among the other important causes of death as fourth or fifth in the list, somewhere near malaria, a disease which resembles it in geographic distribution, in frequency of infection, and in its anemia-producing power. It is necessary for public health administrations to recognize preventable diseases in their relative importance, for partly upon that should depend the distribution of their forces in the fight against the different divisions of the foe."

Compressed Chlorine versus Hypochlorite.

Dr. D. D. Jackson, in the June 15, 1912, *Engineering Record*, contributes a short article on "Chlorination at Cleveland." Dr. Jackson points out that since the installation of the new four-mile water intake, that the water supply of the city has been in a satisfactory sanitary condition at all periods of the year, with the exception of the short intervals during which the annual breaking up of the ice has occurred.

The chlorinating plant was placed in operation in September, 1911, but disagreeable tastes and odors were noticed from time to time, which were traced to the use of unnecessarily large amounts of chlorine. Dr. Jackson makes the following statement with regard to the use of liquefied chlorine in place of hypochlorite:

"Compressed chlorine, liquefied under pressure, is now on the market sold in 100-lb. cylinders and can be had at about 8 cents per pound, about double the price of hypochlorite of lime as far as available chlorine is concerned. It has, however, many decided advantages over hypochlorite in that it is a pure and definite product which is absorbed by the water as a gas. It is easier to apply with regularity and its added cost is nullified by the fact that almost no labor is required in its application. No solution tanks are necessary and no lime sludge has to be disposed of. The only installation required for this treatment is a gas pressure regulator with pressure gauges on either side of the regulator. The gas then passes through a series of hard rubber orifices and is absorbed in the flowing water. The only labor required is about 5 min. work to connect up a new 100-lb. tank once in 6 hours in the case of the Cleveland supply."

Referring to typhoid fever in Cleveland the author makes the following remarks:

"In regard to typhoid fever since the new 4-mile intake was installed in 1904 the death rates have been low. The year immediately following the installation of the new intake the typhoid death rate dropped from 48 to 15 per 100,000 and has averaged 16 for the 7 years that this intake has been in use. In spite of the low death rate there have been

occasional times when for short periods the water appeared to be the source of slight infection and this infection occurred always in the early part of the year. It was to stamp out this source of risk that the sterilization of the supply was adopted."

Grass and Weeds.

Many health officers have a good deal of trouble in dealing with grass and weeds which are allowed to grow on vacant lots, etc. We quote the *Daily Picayune* of New Orleans with regard to a legal opinion recently given in that city:

"Attorney B. T. Waldo yesterday sent the following opinion to Dr. O. Dowling, president of the State Board of Health:

" 'Referring to your recent inquiry relative to grass, weeds, etc., growing upon vacant property, streets and sidewalks in municipalities, I desire to say that I have considered the matter from every viewpoint, and that it is my opinion that the State Board of Health has, under Act 192 of 1898, as amended under Act 92 of 1906; under Act 126 of 1912, which is effective Aug. 8, 1912; under the acts anterior to 1898 and dealing with the powers of the State Board of Health, and under the general jurisprudence upon the subject matter, the authority and power to order the removal of these growths either by the municipalities or by private owners of such vacant property.

" 'I understand, of course, that these growths are deleterious to the public health and that they are prone to harbor disease, or disease-breeding insects, and that their removal is in the line of sanitation—a hygienic necessity. Such being the case, there is, I find upon investigation, no distinction whatever between maintaining or permitting a nuisance of this character and any other.

" 'I might add that I have ascertained that many of the muincipalities in Louisiana have ordinances covering this subject matter; there is no reason, should you so desire, why the State Board of Health could not proceed under these ordinances, if convenient. In any event, it is my belief, the State Board of Health may proceed in the premises independent of municipal ordinances, if preferable to the Board.' "

A Clearing House for Milk Supplies.

"A central clearing house for all the milk supplies of Royal Leamington Spa is suggested by Dr. Edward Burnet in his latest report to the town council. 'It would be a very inexpensive matter,' he writes, 'to arrange for a central office, where the churns could be screened and the individual supplies rapidly tested. If the chief suppliers would co-operate with a view to distribution from such a centre, the milk could be handed on to the retailer in suitable bottles, each bearing a municipal seal. The smaller dealers would in time be compelled to fall in; and the present abominable system of emptying the milk on the public highways, and of storing it in the customary dishes, which invite contamination from the dust and flies, to say nothing of its subsequent dilution with water or skim, would be a thing of the past. I have discussed the idea with some of our prominent producers, and have been assured of their cordial support. We only require encouragement from those whom the innovation will benefit most. Whatever the public asks for it will attain. I trust it will join in the pure milk crusade and, by a total reformation of the conditions concerned in the supply of this indispensable article of food, add another to the many attractions of this borough.' "

The Medical Officer, July 6, 1912.

Jingles on Street Cans.

Painted jingles on street cans for holding refuse were tried with success by the women's club of a small Florida town not long ago. The cans were decorated with bright colors and placed conspicuously near the curb, where fruit eaters and careless newspaper readers might be tempted to throw away skins and waste paper. The jingles were so bright and extended such a cordial invitation to everybody to fill the refuse cans that it looked as though the clean-street problem had at last been successfully solved, so far as carelessness with waste material is concerned. For the benefit of other civic workers the ingenious club members sent out copies of some of their magic jingles, one of which runs:

My name is Empty Barrel;
I'm hungry for a meal,
Pray fill me full, kind stranger,
With trash and orange peel.
Washington Post, August 9, 1912.

As Others See Us.

"There appears in the June number of the *American Journal of Public Health* an interesting report from the pen of the secretary of the American Health Association in which that officer points out in plain language why, in his opinion, the Association does not occupy the place it should in public esteem and public affairs in the several nations it represents. He asserts that one of the most potent defects in the existing scheme of the organization lies in the fact that as a more or less efficient machine the Association exists for but a few days each year. The rest of the twelve months it is, so to speak, a mere paper organization. While agreeing in the main with the secretary, we would remind him that such a result is almost inevitable where an area so large as that covered by the American Association is concerned. But we do not think he does full justice to the admirable editing of the journal of the Association—the *American Journal of Public Health*—in which there is collected in a careful and judicious manner an account of what is taking place in the public health world generally.

"Other criticisms of the secretary should, however, receive serious consideration at the hands of the executive committee. For instance, the possibility of electing members only at the annual meeting in whatever portion of the vast American continent that meeting may be held, is an arrangement which is so palpably absurd that it should be amended without further delay, and elections should be arranged for at much shorter intervals.

"Membership of the Association has hitherto been confined to those who have been for a period of three years in the active professional practice of technical branches of public hygiene, or have been for three years on the executive or technical staffs of government departments dealing with phases of public hygiene in the countries represented in the Association. There are also associate members who have qualified under certain specified provisions, foreign members recommended by the advisory council, and delegate members. The regulations covering membership of the Association have already had the effect of keeping out of the Association many persons engaged in public health work who would not only benefit themselves from membership, but who would strengthen the Association and add considerably to its usefulness.

"The centralization of administration, with an adequately paid chief executive officer, is also essential to the successful working of the Association, for which there should be a great future. Indeed, it should contain within its ranks a sufficient number of men of eminence to enable it to give definite advice on sanitary matters to all those who need it and should wield an immense influence not only on the American continent, but elsewhere. We trust the executive committee will be sufficiently far-seeing to adopt a progressive policy so that the Association may take its proper place among similar organizations."

The Medical Officer, July 20, 1912.

The United States Public Health Service.

By an act of the Congress approved August 14, 1912, the name of the Public Health and Marine-Hospital Service was changed to Public Health Service. The public-health functions and duties of the service were extended somewhat, and certain changes were made in the salaries of the officers. A copy of the act follows:

AN ACT To change the name of the Public Health and Marine-Hospital Service to the Public Health Service, to increase the pay of officers of said service, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Public Health and Marine-Hospital Service of the United States shall hereafter be known and

designated as the Public Health Service, and all laws pertaining to the Public Health and Marine-Hospital Service of the United States shall hereafter apply to the Public Health Service, and all regulations now in force, made in accordance with law for the Public Health and Marine-Hospital Service of the United States shall apply to and remain in force as regulations of and for the Public Health Service until changed or rescinded. The Public Health Service may study and investigate the diseases of man and conditions influencing the propagation and spread thereof, including sanitation and sewage and the pollution either directly or indirectly of the navigable streams and lakes of the United States, and it may from time to time issue information in the form of publications for the use of the public.

Sec. 2. That beginning with the first day of October next after the passage of this act the salaries of the commissioned medical officers of the Public Health Service shall be at the following rates per annum: Surgeon General, six thousand dollars; Assistant Surgeon General, four thousand dollars; senior surgeon, of which there shall be ten in number, on active duty, three thousand five hundred dollars; surgeon, three thousand dollars; passed assistant surgeon, two thousand four hundred dollars; assistant surgeon, two thousand dollars; and the said officers, excepting the Surgeon General, shall receive an additional compensation of ten per centum of the annual salary as above set forth for each five years' service, but not to exceed in all forty per centum: *Provided*, That the total salary, including the longevity increase, shall not exceed the following rates: Assistant Surgeon General, five thousand dollars; senior surgeon, four thousand five hundred dollars; surgeon, four thousand dollars: *Provided further*, That there may be employed in the Public Health Service such help as may be provided for from time to time by Congress.

Public Health Reports, Aug. 16, 1912.

Plague and Fleas.

A recent issue of the *New York Times* contains the following interesting communication from Professor William T. Sedgwick.

"With bubonic plague knocking at our Eastern doors it is a pleasure to be able to assure the people of the United States, as you have already done, that there is no likelihood of any general or widespread trouble for us, even from the introduction of this ancient and formerly terrible disease. And this for two reasons: First, because we have, happily, at the head of our United States Public Health Service an expert of worldwide fame in this disease, Dr. Rupert Blue, who won his spurs by grappling boldly, scientifically, and successfully with the plague when it broke out a few years ago on the Pacific Coast, and, second, because this disease is transmitted by fleas, and we are not naturally a flea-bitten people.

"Bubonic plague appeared a year or two ago on the east coast of England not many miles north of London, causing much anxiety among the public health authorities and some popular alarm, but although it proved very fatal to rodents, especially rats and rabbits, it did very little harm to mankind, and was soon checked, probably because the English also are as to their persons comparatively free from fleas."

The Importance of Bovine Infection in Human Tuberculosis.

"In the *Revue d'Hygiene, 20th Avril, 1912 Vol. 34. No. 4.*, three important papers are contributed by Professor Calmette of Lille. A summary may be given of the first of these, read before the International Conference on Tuberculosis, held at Rome during last April. In this paper Calmette discusses the relative importance of human and of bovine infection in human tuberculosis. After a short summary of the history of the subject, and a reference to the differences between the two strains of bacillus as regards their morphological and cultural characters, and their virulence towards test in animals, the author notes the recent work of Weber, Theobald Smith, Park, Hess and of the British Royal Commission, and shows that the bovine bacillus, at any rate when received in repeated and large doses, is capable of infecting young children. Thus Park finds that 26.5 per cent of all fatal cases of tuberculosis at ages

0–5 years are due to infection by bacilli of the bovine type, as shown by the morphology of the organism isolated and its virulence towards the rabbit. Above 16 years, on the other hand, the corresponding proportion is not more than 1.3 per cent, while in the case of pulmonary tuberculosis the human type of tubercle bacillus is found almost without exception.

"Calmette points out, however, that the researches of Weber and of Hess show that, for infection to occur even in early childhood, frequently repeated and massive dosage with bacilli of the bovine type is required. 'Now, this condition is but seldom fulfilled, so that the danger of infecting man through the milk of tuberculous cows must be admitted to be much slighter than has of late seemed probable to hygienists and bacteriologists.' The paper concludes with a statement which may be rendered as follows: 'The chief danger to man, whether in childhood or in adult life, occurs when there is intimate association with patients suffering from open tuberculosis. For these most undoubtedly afford a repeated and often massive infection, which even the most resistant constitutions are powerless to withstand.' "

Public Health, Vol. XXV, No. 10.

Combating Infant Mortality.

Persons directly interested in this important topic will find an article by Doctor Abraham Jacobi in the *Journal of the American Medical Association for June 8th, 1912*, well worth reading. The title of Doctor Jacobi's paper, which constituted his presidential address for the American Medical Association at Atlantic City this year, is, "The Best Means of Combating Infant Mortality." The paper is rich in personal experience and wide knowledge, and is written in a stimulating, suggestive style.

Doctor Jacobi concludes as follows:—

"Now, my friends, you have been kind to me and patient, as hundreds of times before. That is why I shall now finish in a minute with a few conclusions for those who are with me are convinced that healthy women and living vigorous infants are the best possessions of this nation. They will not be conquered with treasures and cannon and corpses of countless men; they need conservation only. What I want is that a pregnant woman should be in a condition to carry her fetus to its legitimate end in health and vigor, and be able to nurse her infant. Every text book talks to us of the inability of women to do so, and indicates formulas and tradeshops and factories from which to graduate toothless young Americans. One hundred per cent of our women, however, can be made to nurse, even the 'flower and fashion' of the land. From two to three times as many babies will live when breast-fed compared with the number of those whom they complacently try to raise on artificial foods. By breast-feeding you will save 100,000 babies that now die or become invalids, from no other cause but unnatural feeding.

Dangers which now attend the process of parturition for more than one-half of the women of this country must be modified, relieved or removed by the presence of a person instructed to conduct a normal labor, and, when needed, to call timely aid. We want, for the benefit of the women who need midwives, 200 midwifery schools after English or German pattern. Let no legislature of any state pass without a bill or law to safeguard the newcomers andtheir mothers.

A town without an amply supply of good doctors and midwives and a village without one or two competent and responsible and licensed midwives, are like a tenement house without a fire-escape or a *Titanic* without life boats."